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USSR REPORT

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AVIATION AND COSMONAUTICS

No 12, December 1985

Except where indicated otherwise in the table of contents the following is a complete translation of the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow.

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AIR FORCES DEPUTY CHIEF ENGINEER URGES EFFORTS TO MASTER NEW COMBAT AIRCRAFT

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 1-3

[Article by Maj Gen Avn G. Matveyev, chief, Aircraft Maintenance Directorate, deputy chief engineer of the Air Forces: "High Level of Mastery of Modern Equipment"]

[Text] Thanks to tireless concern by the Communist Party and Soviet Government, as well as persistent labor by scientists, designers, and aviation industry people, increasingly more sophisticated aircraft are continuously being delivered to the Air Forces. This equipment embodies Soviet scientific and technological advances in the areas of electronics and automatic control, aerodynamics and jet-propulsion engineering, and technology of manufacture and machining of ultrastrong and heat resisting metals and alloys. It is quite logical that providing our glorious Air Forces with modern hardware enhances their combat capabilities, while the equipment and weapons carried by new-generation fixed-wing and rotary-wing aircraft, their specifications and performance characteristics, air traffic control and flight operations support facilities make it possible today to carry out the most complex combat training missions in virtually any weather and tactical environment.

At the same time all this is characterized by continuous qualitative changes, by increasing complexity of design and construction, aircraft operating principles and, correspondingly, the methods of aircraft maintenance and combat employment. Therefore demands on aircraft maintenance specialists, their level of professional knowledge and skills and, consequently, on quality of engineering and technical training as well are increasing with each passing year. A steady increase in the technical knowledgeability and professional skills of flight and engineer-technician personnel is a most important condition for successful accomplishment of the tasks assigned to Air Forces units and subunits in the new training year. Taking part in socialist competition to greet in a worthy manner the 27th CPSU Congress, aviation personnel are deepening their theoretical and scientific-technical knowledge and are improving methods of efficient readying of fixed-wing and rotary-wing aircraft for flight operations.

As we know, acquisition of solid knowledge and skills, the ability to maintain and operate new aircraft equipment knowledgeably and on a scientific basis is

a rather complex and multifaceted process. Therefore intensity of combat training has not diminished for a single moment in Air Forces units and subunits from the very first days of the new training year; socialist competition to greet the forthcoming party congress in a worthy manner is gathering momentum. Aviation personnel are working tirelessly to improve their combat skills in the classrooms and on the airfields, in practice areas and on the ranges, learning to squeeze out of modern aircraft systems every bit of performance engineered into them by the designers.

At the tactical air exercise held in the concluding period of the last training year, for example, Air Forces personnel displayed excellent results in combat training and performed boldly and smoothly in the most complex weather and tactical conditions. Pilots and navigators demonstrated increased air proficiency and weapons skill, while aviation engineer service specialists showed the ability to ready fixed-wing and rotary-wing aircraft for important training sorties in a prompt and high-quality manner and to maintain them in a state of continuous combat readiness.

We can presently state with confidence that the profound and diversified knowledge of theory and skills acquired in the course of daily engineer and technician training in the past year enabled aviation engineer service specialists of aviation units and subunits successfully to master new, advanced methods of maintaining modern aircraft and to broaden their scientific and technical knowledgeability.

The men of the aviation units in which vanguard aviation engineer service officers R. Sirayev and V. Paliy serve have achieved excellent results in combat and political training and have worked for an extended period of time without potential air-mishap situations blamable to aviation personnel. The overwhelming majority of these units' flight and engineer-technician personnel are specialists 1st and 2nd class and master-rated. What is the foundation of the success of these outfits? First and foremost purposeful political-indoctrination work, efficienct, coordinated efforts by the command authorities and party organizations, directed toward effective utilization of diversified forms and methods of combat training, high demandingness and integrity, and an objective appraisal of achieved results.

Such forms of technical training as scientific-practical conferences, lectures and classroom group sessions, seminars and simulator training sessions, tests and technical analyses, independent study, technical lecture series and study groups are being successfully utilized in the units to boost the level of technical knowledge of aviation personnel and to strengthen their skills in maintenance and combat employment of modern aircraft.

We can state on the basis of the positive experience of these military collectives that the most appreciable effect in improving quality of readying aircraft for flight operations can be produced by thorough, differentiated planning and scheduling as well as consideration of the level of knowledge and skills of every aviation engineer service specialist and the specific features of the aircraft being maintained and operated.

It is gratifying that such an approach to things is also typical of many other aviation units. In the outfits in which the aviation engineer service is headed by officers V. Aksenov and A. Barabash, for example, this has made it possible sharply to improve the quality of mastering the operation of and servicing new aircraft, totally to eliminate near-mishap situations through the fault of personnel, and to achieve high results in socialist competition to greet the 27th CPSU Congress in a worthy manner.

Good training facilities were established in the past training year by joint efforts of commanders and political agencies, party and Komsomol organizations in many units for achieving further improvement in the quality of combat training. Officer-Communists P. Bogatyrskiy, A. Sushchevskiy, and V. Belyakov did a great deal of work on devising means of mechanization, improving training classrooms, various displays and instructional aids, which gave a maintenance and technological thrust to lecture halls. These officers are rightly considered top methods specialists and engineer-technician training instructors.

As we know, today's fixed-wing or rotary-wing aircraft is a crew-served weapon. In the air they are utilized by pilots, navigators, aerial gunner-radio operators, flight engineers and technicians. At the same time effectiveness of utilization of this weapon is ensured on the ground by the team of aviation engineer service specialist personnel. Low proficiency on the part of even one of them can nullify the common efforts. This is why it is essential that every single ground maintenance specialist becomes fully proficient at his job, a genuine aircraft expert. This has always been one of the principal demands in aviation. Its importance increases 100-fold in present-day conditions.

The fact is that the process of mastering new-generation aircraft has required differentiation, a finer subdivision of military occupational specialties, especially at the junior engineer-technician personnel level. There has also been a considerable increase in the volume of knowledge which must be possessed by every airman, not only in his own but in other occupational specialties as well. This requires on the one hand 100-percent involvement in occupational training for all personnel of Air Forces units. Today we can simply not tolerate failing to attend engineer-technician training classes, as sometimes happened in the past in some subunits. Practical experience unequivocally attests to the fact that if an aviation engineer specialist has failed to attend such classes, this constitutes a gap in his training and a source of defects and errors of omission in aircraft servicing and maintenance.

On the other hand there should be more extensive practice of the method of independent training as a principal type of engineer-technician study not only for officer personnel but warrant officers as well, and noncommissioned officers and enlisted personnel in some occupational specialties. It is important that this method be properly organized and monitored, for the fact is that in some aviation outfits classes for all engineer-technician personnel are sometimes held in a single lecture hall on the same topics, while high proficiency-rating specialists and master-rated individuals are perfectly capable of deepening their knowledge on their own.

In organizing engineer-technician training in the new training year, we should eradicate shortcomings noted in the past. Holding of classes in a hasty manner, in rooms ill-equipped for this purpose, poor preparation of instructors and students, and lack of relevancy of subject matter ahve diminished the quality and effectiveness of engineering and technical training. A seasonal nature of and poor attendance at classes have had an adverse effect. Inadequate attention would be paid to the professional training of class instructors. Instruction-methods work would not be conducted with them on a regular basis. Frequently there would be instances of nonobjective evaluation of the knowledge of aviation personnel in tests, at seminars, and at group class sessions. Independent study by aviation engineer service officers would at times be conducted in an unsystematic and perfunctory manner, and there would be little effort to verify the quality of preparation of individual study topics by aviation specialist personnel. In some instances training classes would be nothing more than a simple demonstration of procedures and techniques. Technical analyses would also be insufficiently utilized in training personnel.

Just what impedes organizing engineering and technical training in line units in a thoughtful and original manner? The documents which govern aviation engineer service demand that organization of the methodology of individual study be improved. We feel that errors here are due first and foremost to inadequate preparation on the part of certain leader personnel at such a level as subunit deputy commanders for aviation engineer service, who include many young officers. They themselves must be instructed taking into account their job skills and work experience.

In this connection I should like to express my agreement with the opinion of many participants in the discussion, conducted on the pages of the journal AVIATSIYA I KOSMONAVTIKA, of an article by Maj Gen Avn A. Grishin entitled "The Squadron Engineer. What Should He Be?" which appeared in November 1984. In fact, today's subunit aviation engineer service supervisor should be a person who thinks innovatively, who has a good understanding of the sociopolitical aspects of scientific and technological advance, who possesses initiative, and who is a demanding organizer of training and indoctrination of aviation personnel.

This is why it is important that every squadron deputy commander for aviation engineer service be thoroughly aware of his responsibility for organization of personnel combat training and understand the fact that a successful job of training and indoctrinating subordinates can be done only by he who possesses broad knowledgeability, a high degree of theoretical and specialized training, with a consummate mastery of Marxist-Leninist methodology, who understands education science and psychology, who is constantly increasing his military and scientific-technical knowledge and honing his job skills.

A priority task consists in ensuring that those who teach and indoctrinate squadron aviation engineer service personnel themselves become specialists 1st class and constantly concern themselves with increasing their teaching skills. Teaching methods work with engineering-technical training instructors must be conducted on a regular and systematic basis, more extensively utilizing the

capabilities of military educational institutions for this purpose, conducting demonstration and instruction-methods classes and conferences, considering and boldly adopting the know-how, experience and methods innovations of the top command personnel and engineers.

The complexity of the aircraft which are being delivered to the line units and the daily practical aspects of the servicing and maintenance of these aircraft urgently demand that we seek more efficient forms of determining the degree of technical knowledgeability of aviation engineer service specialists, that we accomplish practical adoption of new methods of engineering-technical training and, on the basis of this, change in the conditions of authorizing personnel independently to perform disassembly-assembly and adjustment procedures on aircraft equipment. An important role in this should be played by computerization of the training process on a microprocessor foundation, which opens up considerable opportunities for thorough study of the fundamentals of the technical sciences, development of the cognitive activities of trainee personnel, and intensification of all forms of aviation personnel combat training.

In addition, we must secure a state of affairs across the board whereby the quality of mastery by each and every aviation engineer service officer of the scheduled topics pertaining to engineering-technical training is mandatorily monitored, graded, and entered in specific documents by the appropriate superior. It is beneficial thereby for aviation engineer service specialists who have independently studied and mastered a given topic to give a presentation to their colleagues. The latter will learn something new, while the individual giving the presentation will reinforce his knowledge. This is especially important for young aviation personnel.

I feel that it is high time to adopt an appropriate "maintennace specialist's logbook," similar to a pilot's logbook, which would contain detailed data on the degree of professional competence of a given maintenance specialist to perform various operations on a fixed-wing or rotary-wing aircraft.

Aviation units possess every capability to accomplish fruitful engineering-technical training. They receive technical literature, posters and diagrams. A large portion of classroom teaching aids are centrally produced and distributed. Those commanders and their aviation engineer service deputies, however, who believe that everything for organizing engineering-technical training classes should come exclusively through regular supply channels are profoundly mistaken. Local preparation of instructional aids and materials is a part, and a fairly substantial part of the overall process of aviation personnel training. And to accomplish this important task it is necessary more boldly to enlist as many aviation engineer service specialists as possible of various categories.

In addition, brief training courses are prescribed in aviation units at the beginning of each period of training, for aircrews and engineer-technician personnel, at which principal attention is focused on studying new aircraft, the operating principles of individual aircraft systems and equipment, servicing and maintenance procedures, and procedures of readying for combat utilization. In each aviation unit requisite time for engineering-technician

training is also allocated during commander training days each month, between training courses. Considerable available time for such activities is opened up in the course of the training year when flight operations are postponed for various reasons. It is the duty of commanders at all echelons and their deputies for aviation engineer service to utilize training facilities and allocated time, throughout the entire training year and in a purposeful and innovative manner, to accomplish further increase in the job-related knowledge of aviation personnel. Engineering-technical training in aviation units should be organized in such a manner that each and every hour of training produces maximum return, promotes further improvement in the quality of servicing and maintenance of aircraft equipment, and meets the level of present-day demands. And as we know, these demands are growing.

"Right now, when the party is advancing toward the 27th CPSU Congress," noted CPSU Central Committee General Secretary Comrade M. S. Gorbachev, "when the congress program documents are being prepared, it is important to recognize that acceleration of scientific and technological advance is essential to us." And at this point one can scarcely exaggerate the role played by the human factor, which signifies that success in any undertaking depends in the final analysis on people. This also applies in full measure to military aviation personnel. Today know more than yesterday, tomorrow more than today; today do better than yesterday, tomorrow better than today -- these words should be adopted as a motto by each and every aviator, by each and every aviation engineer service specialist in the new training year. And there is no doubt of the fact that the homeland's air defenders will accomplish their tasks in an honorable manner and will mark the 27th CPSU Congress with additional successes in socialist competition, in order to achieve further increase in the combat readiness of Air Forces units and subunits.

3024
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INDIVIDUALIZED APPROACH URGED IN BREAKING IN FLEDGLING COMBAT PILOTS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 4-5

[Article, published under the heading "Be Alert, In a Continuous State of Combat Readiness," by Flight Commander Military Pilot 1st Class Capt A. Omelchenko: "Young Pilots Attack"]

[Text] Undulating waves of white clouds stretched out far below. The shadows of the fighter-bombers, returning home from the range, skittered silently along the cloud tops. Young combat pilot Lt A. Korzhilov was in high spirits. He had accomplished a critical phase of combat flying -- weapons delivery -- with high marks.

Keeping close watch on his leader, Lieutenant Korzhilov endeavored to maintain precise forward spacing. Several minutes later the two aircraft plunged into the clouds. It became more difficult to maintain his position in formation. Suddenly the lieutenant had this feeling that his aircraft was wandering off course. Although his instruments confirmed that he was holding parameters correctly, the pilot nevertheless yielded to this disorientation and committed a gross error....

This incident occurred quite some time ago, but it is still remembered in the squadron, since it occasioned a serious discussion about the performance of flight commanders and instructors in training novice combat pilots. A comprehesive analysis of the training process resulted in revealing a number of deficiencies in their work.

An inadequate level of proficiency on the part of flight personnel often is the cause of mistakes in the air. The case of Lt A. Korzhilov was no exception. A subsequent analysis revealed that flight commander Capt V. Kozintsevskiy, who should have prevented such an error by his subordinate, was to blame in part for the novice pilot's mistake. The fact was that the instructor had failed to evaluate in a prompt, firm and high-quality manner the flying technique of Lieutenant Korzhilov. When he had flown dual with the young lieutenant to the practice area on the previous day, Captain Kozintsevskiy had failed to note the roughness in the novice pilot's flying technique, and after their return he had limited his post-flight critique to a single word, "normalno" [adequate level of performance]. It was failure to

note "trivial items" which resulted in the officer making an error on his next solo training sortie.

In the past we had frequently encountered such things. Sometimes after a training flight certain flight commanders, instead of a thorough and detailed critique and analysis of their men's performance, would limit themselves to a perfunctory: "v norme" [adequate level of performance]. Obviously there is little benefit from such an evaluation. And yet the flight instructor can see more clearly than anybody else the strong and weak points of a novice pilot. Since this is the case, he has a broad potential area of activity. But at the time many people in our subunit were giving no thought to this. As a result "trifles" accumulated, took root, and subsequently young combat pilots had a difficult time correcting them. A formal analysis of the flight also led to the conclusion that pilots were paying almost no attention to the repetition of minor errors, were complacent, and were beginning to believe that they were infallible. From here it is only a short distance to serious potential air-mishap situations.

At a meeting of the unit methods council, when the matter of training fledgling pilots was examined, the following deficiency was revealed. Some flight commanders were treating in an excessively simplified manner the preparation of their men for such a difficult phase of combat training as IFR and night flying. They felt that it was sufficient to teach a pilot to fly by the gauges and to fly a landing approach utilizing navaids and other electronic systems. And few made an attempt to understand the psychological state of a novice pilot or to take a good close look at him on the eve of a critical training flight. Sometimes a fledgling combat pilot's considerable nervousness and doubts about the outcome of an instrument flight remained concealed from his mentor, and yet a flight commander plays a very important role in determining that psychological and emotional barrier which sometimes occurs in a novice pilot during the training process. I shall cite an example.

While practicing flying technique in a dual trainer, one of the pilots in Capt M. Smolyakin's flight was slow in responding to instructions from the tower and his flight instructor and would become confused in simple situations. What was the problem? It was ascertained that the lieutenant had received a disturbing piece of news: his father had fallen seriously ill. Captain Smolyakin went to the squadron commander with a request that the pilot be permitted not to take a scheduled solo training flight that day. This action was most timely. The young officer did not lose self-confidence, and during the following flight operations shift he performed with confidence and composure.

A party meeting helped us considerably in specifying ways to correct deficiencies in training novice combat pilots. A meaningful discussion was held at this meeting, which made it possible to adopt in a timely manner substantial adjustments in the training and indoctrination process. All this produced positive results -- things improved considerably in the outfit.

A rule has been established in the squadron: if a pilot newly assigned to a flight is less proficient than his comrades, the degree of the subunit's

preparedness is now determined on the basis of the newcomer. This increases incentive for all members of the collective to ensure that their young comrade boosts his level of proficiency as rapidly as possible. In addition, rapid breaking-in of a newcomer is also dictated by considerations of combat readiness.

For this reason considerable importance is presently being attached to increasing the proficiency rating of aviators in our squadron's flights. At the beginning of each training year the subunit thoroughly analyzes those factors which primarily determine the pilot training process. They include weather conditions at our airfield month by month, capabilities of the aviation system and technical personnel, professional competency of isntructors, plus many other factors. We have become convinced through our own experience that if all these nuances are not taken into consideration during the period of preparation for the new training year, it will be difficult to accomplish even targets which are well within capabilities.

Consideration of the individual characteristics of crew members merits particular attention, and here is why. It has long since been noted that some individuals gain a rapid grasp of things, but are capable of rapidly losing an acquired skill if they do not continuously reinforce it with regular practice. Others advance more slowly through the training program, but their training is more thorough. Therefore one must apply a strictly individual approach in the training process. For some individuals it suffices to point out a mistake, and they will make every effort never to make it again. Others require a clear explanation, with description of the physical processes involved. An individual approach is needed in both cases.

When Lt Kh. Deynov joined the squadron, flight commander Maj V. Artyukhin first of all endeavored precisely to determine his level of proficiency, in order more efficiently to map out a schedule of breaking in the new pilot. He took into consideration the psychological fact that a pilot's attitude toward mastering a complex flight training program is determined by many components, including the quality of execution of individual maneuver sequences. The flight commander gave the lieutenant the opportunity fully to demonstrate his flying proficiency. At a recent tactical air exercise, which involved landing at an unfamiliar airfield, this officer performed like a fully-proficient combat pilot. This greatly strengthened his morale. He became infused with greater confidence.

One specific feature of training of inexperienced pilots in adverse weather conditions in my opinion lies in the fact that sometimes one must wait a long time for the requisite weather. In order not to lose precious hours of training, we set up so-called ready schedules, on the basis of which both aircrews and aircraft are readied in advance. This enables us to begin flight operations without delay, as soon as long-awaited weather conditions appear. This method enables us more fully to accomplish scheduled training activities.

In the process of combat training we have become convinced how important it is for flight commanders and instructors to consider the breaks which aviators experience in various parts of the flight training schedule. Experience indicates that if this is not carefully watched, in the final analysis the

combat pilot will inevitably need to go over again once-covered ground. This means a slowing of the training process and wasteful expenditure of training time, aircraft, and the labor of aircraft maintenance personnel.

Successful implementation of fledgling combat pilot training schedules depends to a considerable degree on the degree of honesty with which they report mistakes they make, for an instructor, even the most proficient, is unable to spot all errors in the process of flight training. For example, one officer candidly admitted that when dive-bombing he was apprehensive about completing pullout below the minimum safe altitude. The squadron deputy commander thoroughly examined the situation, flew dual out to the range with the young officer, and demonstrated variations of target run and methods of aircraft recovery from target attack dive. The pilot gained confidence and began performing with greater boldness and decisiveness.

Training fledgling pilots is a painstaking process, requiring considerable time and effort. Wherever this task is approached in an innovative manner, with an individual approach to each pilot, the training process moves along smoothly, and pilots more rapidly acquire the needed skills.

...Flight operations were in progress. Fighter-bombers were taxiing out to the active and taking off one after the other. Finally it was Lt M. Tashkov's turn to take off, his combat aircraft disappearing into the cloud cover. He vigorously executed a missile-evading maneuver, quickly located his target, and hit it with precise accuracy. He then broke off and headed homeward. Lt Ya. Konchenko and L. Fazilinchuk were approaching the range at this time. Through their daily labor these young combat pilots are improving their proficiency, their weapon and tactical skills. They are endeavoring to greet the 27th CPSU Congress in a worthy manner with new accomplishments in combat and political training.

3024
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PLEA MADE FOR IMPROVED FLIGHT SAFETY

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 6-7

[Article, published under the heading "Constant Attention to Flight Safety," by Honored Military Pilot USSR Col Gen Avn A. Yelkin, deputy chief, USSR Armed Forces Central Flight Safety Inspectorate: "Flying Safely, Without Accidents"]

[Text] The calendar year is drawing to a close. Final combat training results have been tallied up in the units and subunits, and tasks to be accomplished in the new period of training have been assigned. The job skills of pilots, navigators, and specialist personnel of the aviation engineer service and supporting subunits are increasing from one flight operations session to the next. The experience of vanguard units indicates that an intense work pace is the best thing to promote the conduct of flight operations without air mishaps, mishap-threatening or near-accident situations, mobilizes personnel to engage continuously in the search for ways to ensure flight safety, and forces one to be in good form at all times, as they say.

In such outfits work is organized according to the principle of maximum benefit from each and every training class, practice session and drill. For example, in the outfit headed by Military Pilot 1st Class officer A. Kopytov, transition training over to new aircraft was accomplished in a short period of time and with excellent quality, without a single failure to observe the documents which govern flying procedures. What fostered this success? First and foremost it was a thorough understanding by leader personnel of the importance of the assigned tasks, precise planning of training classes and practice sessions, and a high level of proficiency on the part of instructor personnel. Aviation personnel thoroughly assimilated the fact that as aircraft become more sophisticated, the required level of flight safety has become imcomparably greater, while air mishaps and near-mishap situations which sometimes occur are a consequence of poor organization of flight operations and inadequate preparation by flight personnel. The campaign against accidents is a matter of national importance, to which the party and government have devoted and are devoting unrelenting attention.

At the present level of development of aviation technology, some measures to ensure flight safety which are currently in effect have become insufficiently

effective. The need has arisen to seek out new reserve potential and additional ways and methods of increasing safety, which are in maximum conformity with the complexity of present tasks and the conditions of performing them.

Practical experience and science attest to the fact that air mishaps are engendered by an aggregate of factors. These include personal factors, manifested in mistakes and rule violations by persons involved in organizing, preparing for, carrying out and supporting flight operations; technical, involving malfunctions in the operation of aircraft engines, equipment and systems; factors which cause external, unpredictable effects on an aircraft and its crew. The principal causes of air mishaps and near-mishap situations involving incorrect actions by flight personnel include crew member errors and lack of discipline in the air, deficiencies in organization of flight operations and air traffic control, as well as poor-quality preparation and preflighting of aircraft. While due to the adoption of new objective monitoring devices the number of violations of procedures connected with personnel indiscipline have decreased, the total number continues to remain unchanged due to deficiencies in organization of flight operations and air traffic control. There has been an increasing frequency of occurrence of cases of exceeding operating restrictions and aircrews proceeding into weather below minimums. Frequently not only pilots but ATC personnel are to blame for this. Attempting to carry out the flight operations schedule at all costs, and realizing that violations could result in serious consequences, flight operations officers sometimes compromise with their conscience. They allow aircrews to go up on the basis of local conditions and going no further than the conduct a weather reconnaissance update in the direction of weather fronts. When the weather abruptly deteriorates, the situation ends at best with a diversion of aircraft to an alternate field.

One readily notes that a mishap-potential situation or an air mishap is directly related to the professionalism and efficiency of the aircrews involved. The greater their professionalism and efficiency, the fewer the errors and infractions: the commander -- in organizing flight operations, the pilot -- in executing the flight, and the technician -- in preflight-readying the aircraft. Also important is proper monitoring of each flight. This makes it possible to detect an error at the very outset and to take prompt steps to correct problems. I shall cite an example.

In the aviation outfit under the command of Military Pilot 1st Class Lt Col V. Gnezdilov, interpretation of flight data recorder tapes was conducted in a disorganized manner, with gross violations of the provisions of documents regulating flight operations. Over a period of 3 months there was a failure to discover near-mishap situations caused by pilot error. Results were soon in coming -- an aircraft crashed while on a landing approach. And this is understandable. If the flight recorder tapes had been carefully and thoroughly analyzed, it would have readily been noted that the pilot had previously made errors on his landing approaches. For this same reason a gross pilot error occurred in the unit in which Military Pilot-Expert Marksman Col A. Bolezin serves, resulting in an airplane crash.

I should particularly like to emphasize the importance of proper flight operations planning and scheduling as well as post-flight debriefing, analysis, and performance critique. Every commander should know how maximally to utilize the capabilities of his men in order to improve flight safety, for it still sometimes happens that a pilot, after spending a good deal of time on preparation, flies only a single training sortie at the end of the flight operations shift. Of course such an approach to things is unwarranted. It is dangerous to allow into the air an officer who has sat around waiting on the flight line during an entire flight operations shift. Wherever it is well remembered that safety is determined in large measure during the planning and scheduling process, they do not have such violations of regulations.

Experienced commanders have not only flight personnel but also specialist personnel from the supporting subunits attend a post-flight critique and analysis session. Aviation personnel errors are analyzed when things are still fresh in people's minds, using charts and diagrams which illustrate pilot errors, and exhaustive recommendations are made on how to proceed in a given situation. When organized in this manner, the post-flight analysis becomes a genuine school of professional expertise. Aggregate performance results in combat training for the month, which are tallied at the flight, squadron, and regimental level, are grounded not only on evaluation of the state of affairs at each level. They incorporate determination of the causes of violations of procedures and regulations, as well as errors and mistakes. When performance results for the month are totaled up, specific measures are specified for correcting revealed deficiencies.

In organizing, planning and scheduling flight operations, command personnel must rigorously seek to ensure that a flight assignment is in keeping with an aviator's attained level of training and his proficiency rating. As a rule a discrepancy between level of proficiency and difficulty of assigned tasks leads to haste, pushing the pace on preparations, connivance, and lack of supervision. Command personnel who seek to meet schedules at any cost and to make up for lost time proceed to ignore flight rules and regulations, the requirements of documents regulating flight operations, and conclusions grounded on many years of experience. It still sometimes happens that pilots who are not fully prepared are permitted to fly training missions, and inexperienced officers are allowed to work air traffic control. This hinders a precise operating rhythm, impedes the conduct of flight operations without air mishaps or near-mishap situations, and diminishes the reliability of accomplishment of complex task assignments.

Also important is the ability of aircrews to work independently during the hours of preliminary preparation for training flights. Experience indicates that flight safety depends on this to a great extent. Time for preparation is specified by the daily schedule, and its quality is evaluted during the readiness check. The successful outcome of a flight, and consequently flight safety as well, is determined in the final analysis by the objectiveness of a commander's evaluation.

A high degree of professionalism and efficiency are derivatives of the process of personnel training and indoctrination and their overall proficiency. This becomes possible only with well-equipped training facilities, the availability

of highly-trained instructors, and correctly-organized party-political work. Deficiencies in the training-methods foundation make the training process lengthy and fail to ensure acquisition of adequate knowledge and skills. The experience of vanguard units attests to the effectiveness of a method whereby the flight commander works directly in the aircraft cockpit or on the flight simulator together with his pilots, manual in hand, and at the end of the practice session tests his men to the extent of the flight task assignments which they will be performing. Rehearsing a "flight" in the simulator cockpit provides the opportunity to reestablish lost skills, especially if there has been too long a layoff on specific types of training. Special attention is devoted to practicing responses to the most dangerous emergency situations.

Also of considerable importance is the psychological factor in simulator or drill preparation, since an officer is rehearsing a unique emergency reserve of responses in case the situation in the air becomes complicated. Inadequacy of psychophysiological stability leads to confusion, loss of ability to analyze incoming information, loss of self-monitoring and confidence. The pilot begins to act hastily and in a confused manner, which when time is of the essence can affect safe conclusion of the flight.

I recall an incident involving Military Pilot 1st Class Maj V. Lapshin. He was on a night flight at weather minimums. The tower instructed him to land his aircraft on the first approach, since there was a thickening layer of haze at 200-300 meters. Upon turning to his final approach heading, Lapshin failed to switch to automatic mode and was 70 meters low as he approached the outer compass locater. At 3 kilometers from touchdown the tower informed him: "You are right on localizer, low on glideslope."

The pilot, who was actually at a height of 70 meters, cheerfully replied: "150."

Subsequently he took his eyes off the gauges as he looked for the runway, and at 750 meters from the runway threshold the aircraft struck the elevated approach lights. It was pure luck that this flight did not end in tragedy for Lapshin.

The accident investigation board concluded that one of the contributing factors to the accident was the fact that an inadequately-prepared pilot had been allowed to go up when weather was at minimums, as well as deficiencies in organization of flight operations and air traffic control. Nevertheless I feel that an important role in this accident was played by Lapshin's lack of sufficiently strong psychological qualities. In addition, his immediate superiors and the senior-level officers had failed objectively to evaluate his actual level of proficiency. His proficiency can be rather fully judged by the flight data recorder tapes. The picture would have been clarified with an analysis of the pilot's procedures in the air. It was ascertained, however, that not all command personnel in this outfit have the ability correctly to interpret flight data recorder tapes and to use this information to judge the proficiency level of flight personnel.

The experience of units which have gone for an extended period of time without accidents and mishap-threatening situations convinces us that one of the

conditions for success is a high degree of demandingness by leader personnel on themselves and their subordinates. An uncompromising attitude in matters of flight safety and a feeling of responsibility for the task at hand should be combined with the ability to discover violations of flight procedures in a timely manner, to identify the guilty parties, and to determine punishment. This is no simple matter and requires a serious approach, for there have been cases where an ATC controller, failing to grasp the situation, has with his instructions placed a pilot into an even more difficult situation. And the mishap-threatening situation would be subsequently written up as inadequate pilot proficiency.

Demandingness calls for rigorous execution of orders issued by superiors and mandatory verification of execution. This is not an expression of distrust but rather a necessity which should not be ignored. Sometimes in the press of daily activities a commander is unable to verify execution of certain instructions, and this affects flight safety. In a certain unit, for example, due to carelessness on the part of command post specialist personnel there was a delay in shifting equipment over to the backup power source when the primary power source failed. As a result the command post "went blind," and two aircraft came dangerously close to one another en route. If the officer in charge had checked the backup generator in a prompt and timely manner, this of course never would have happened.

The modern airplane (helicopter) is a crew-served weapon. It is readied by a great many specialist personnel, and in flight it is supported by a large number of electronic systems and supporting subunits, and this represents certain expenditures of labor and materiel. Performance deficiencies by a pilot or ground specialist can nullify the labor of a large team of people. Only when all aviation personnel have a strong sense of personal responsibility is it possible to achieve smooth operations and excellent results in combat training.

Unit headquarters performs an important function in organizing training. It is a unique nerve center, which handles planning, scheduling, and organization of the daily life and activities of the aviation unit and verifies execution of orders, instructions, and documents. The headquarters staff plans measures pertaining to combat and political training and specifies ways to accomplish more effective and high-quality mastery of the aircraft and to attain maximum safety during each and every flight. The specialized services also make a definite contribution to the common cause, but we feel that the corresponding headquarters staffs have a good deal to accomplish in order to free more time for ground preparation and commander training, to ensure that flying hours are utilized with maximum effectiveness. There will then be an increase in the average number of annual hours logged by pilots and, as a consequence, their professional expertise will increase.

Flight safety should be achieved not purely for the sake of safety but in order to achieve excellent results in combat training with minimum risk. This presupposes both that scientific organization of labor be incorporated in the units and that standard training methods be utilized across the board, for it also sometimes happens that one and the same element of flying procedures is taught differently in neighboring regiments, especially in military

educational institution regiments. Methods councils must pay strong attention to this. A lack of uniformity of training modes and methods affects the quality of flying procedures and can lead to unexpected problems when working on mastering new elements of flight procedures and types of training sorties.

Experience indicates that wherever a high degree of job proficiency is combined with firm military and flying discipline, wherever firm observance of regulations prevails, air mishaps and mishap-threatening situations have been eliminated. Confusion and disarray in an aviation unit or garrison as a rule carries over to the airfield and directly affects combat readiness and flight safety. Accident-threatening air situations are inevitable in such an outfit. In addition, in view of the fact that discipline on the part of subordinates is in a direct relationship to discipline on the part of command personnel, one can judge an outfit's smoothness of coordination and combat readiness from the attitude of leader personnel toward the assigned task.

Intensive training is in progress at the airfields, in the classrooms, and on the ranges. At the threshold of the 27th CPSU Congress, aviation personnel are making a maximum effort to accomplish all assigned tasks with excellent quality. Precise rhythm and efficiency of combat training are inseparably linked with flight safety. Ensuring flight safety and the serach for new ways to improve it is the business of each and every individual wearing light-blue shoulderboards. Resolution of these issues will make it possible to fly safely, without accidents.

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IMPORTANCE OF ATC TEAM IN ACHIEVING FLIGHT SAFETY STRESSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) p 10

[Article, published under the heading "Constant Attention to Flight Safety," by Military Pilot-Expert Marksman Lt Col I. Lomakin: "It Depends on Every Individual"]

[Text] It was night. The runway-end floodlights evenly illuminated the landing area amidst the surrounding darkness. Things were quiet in the control tower. The silence was broken only by status reports radioed in by aircrews out on a training sortie.

Capt Yu. Ivanov's aircraft was on final. The pilot was returning from a cross-country flight. Circumstances had forced him to remain airborne longer than scheduled, and he was very low on fuel. For this reason the tower controller had vectored him to the field by the shortest route. He would be on the ground in a moment....

Ivanov was holding precisely on the glideslope, calmly reporting his final approach descent parameters to the tower at the prescribed points. The combat aircraft crossed the runway threshold, illuminated by the floodlights.

The calm was suddenly and rudely interrupted. The flight operations officer and his assistant shouted orders over the tower frequency. Sparks showered out from under the aircraft's belly.... They illuminated like a flashbulb the fact of departure by persons in authority from flight rules and regulations, their poor organization, slack leadership and lack of discipline on the part of the pilot.

The aircraft had landed with gear up.... An unbelievable occurrence! It is simply inconceivable how such a thing could happen with today's means of monitoring, checking and surveillance.

Experience indicates that very rarely does an accident occur entirely without warning. It moves to a head gradually but irrevocably if violations of flight procedures and regulations are not stopped at a certain point. A pilot failed to be clear about something during the mission briefing, he did not go through the mission fully during preliminary preparation or, losing his sense of

responsibility, he deliberately violated a regulation -- all this is aggravated by poor preparation for the flight operations shift by the ATC team, both as a whole and individually.

Capt Yu. Ivanov's landing attests precisely to this. In the course of the accident investigation the pilot stated that, wanting to save on fuel, he had failed to lower his gear at the prescribed point, although he had reported gear down and locked to the tower. Subsequently, concentrating on his final approach, he had forgotten to lower his gear. But there is a routine procedure prescribed in order to prevent this from happening. At a certain distance from the runway threshold the final approach controller is supposed to tell the pilot distance remaining to the runway and remind him to make sure he has his gear down. But the tower controller failed to do so. The officer verifying gear extension could have prevented the gear-up landing. It was ascertained that he was from another unit and was simply unfamiliar with the gear-down light configuration on an aircraft of this type. And finally, the flight operations officer should have required that the pilot confirm gear down when crossing the outer compass locator. He failed to do so, however. His assistant was talking on the phone at the time and was also failing to monitor Ivanov's procedures.

It sometimes happens that in the complex "ground-pilot" system there can occur system failure due to inexactitude in somebody's performance. But the entire ATC team is not entitled to make mistakes. This is a fundamental rule for ATC specialists, and when it is observed to the letter, subunit combat training tasks are accomplished without air mishaps or mishap-threatening situations.

Precision actions by the members of the ATC team are of great importance in order to ensure flight safety when there is heavy traffic during IFR weather and when operating at weather minimums. In conditions of low ceilings, low visibility, and snow squalls, aircrews are under considerable mental stress, which can affect a pilot's flying performance. Immediate intervention by ATC controllers to correct pilot errors greatly helps prevent the development of an accident-threatening situation. We could cite many instances when prompt instructions or information helped an aircrew out of a difficult situation and enabled an aircraft to land safely.

As a rule the air traffic controller is familiar with the members of the aircrews with which he works. The experienced tower controller can determine instantly by voice intonation the state of the calling pilot, his frame of mind, and to some degree the situation developing in the air. This enables him to make a correct decision in case the situation worsens.

There is a rule in aviation: prepare thoroughly to perform any task, including air traffic control, regardless of complexity or how often you have performed them. This is dictated by practical experience, and nothing should cause a departure from this rule. Presumption can do a bad disservice. The outcome of a flight, when an emergency situation arises either on the ground or in the air, depends to a great degree on the smooth coordination and skilled performance of the members of the ATC team.

In view of this fact, our unit, for example, regularly holds practice sessions for ATC specialists and aircrews at their work stations. During these practice sessions they run through and analyze not only general items pertaining to assisting an aircrew in distress but also the specific actions of ATC controllers. The fact is that when the unexpected occurs in the air, not only the pilot needs help but the flight operations officer as well. He must be freed of the flood of information and enabled to concentrate his attention on the specific aircrew. In such a situation the flight operations officer's duties are performed by the ATC shift supervisor, the local-traffic controller, or the assistant flight operations officer. These practice sessions enable one to develop a certain reaction to an emergency situation and teach one to issue orders in a clear, calm voice, which in turn has a positive effect on the aircrew's actions.

...Lt V. Sukhov had taken off on his first solo VFR night flight. The flight was proceeding well, but as he was on his landing approach the pilot suddenly reported that his gear would not go down. Thanks to procedures rehearsed at practice sessions, the ATC team responded with precision to the emergency. Flight operations officer Lt Col M. Rodnin took over the handling of Sukhov, while the other airborne aircraft were distributed between assistant flight operations officer Capt O. Karaman and local-traffic controller Maj V. Kryuchkov. Lieutenant Sukhov, responding to the flight operations officer's isntructions, given in a calm and clear voice, correctly manipulated the cockpit devices, got his gear down and locked, flew a smooth final approach, and put his aircraft onto the runway.

Some flight operations officers fail to treat seriously enough the development of thunderstorm activity in the practice areas and en route. In spite of the fact that regulations specify the minimum distance of hazardous weather conditions from the point at which cross-country and local flight activities terminate, they continue to allow aircraft to take off. This is an outright lack of discipline, and no arguments about meeting the flight operations schedule can justify it. Weather is weather, and is capable of severely punishing those who ignore it. ATC specialists should possess precise knowledge of the critical values of dangerous weather conditions and make such conditions known to airborne aircraft.

Recently meteorologists' attention has been drawn by the occurrence of electrostatically-charged clouds. When this phenomenon occurs it is recommended that flight operations cease, since it can cause various instruments to malfunction, which makes it more difficult to fly in IFR conditions. The phenomenon of electrically-charged clouds has been fairly thoroughly studied, and therefore I feel that it should be specified in the manual of flight procedures as a hazardous weather phenomenon.

Our unit's aviation personnel are successfully accomplishing the combat training schedule. The skill of flight and technical personnel is increasing. This is being fostered to a considerable degree by the training methods facilities established in the regiment, with spacious classrooms for training pilots, navigators, and ATC specialists. In the flight data recorder tape analysis classroom flight personnel have the opportunity not only promptly to

analyze errors but also to predict the performance of aircrews and aircraft in the air.

In short, every condition exists for the tough socialist pledges made in honor of the 27th CPSU Congress to be carried out in full.

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KACHA PILOT SCHOOL MARKS 75TH ANNIVERSARY

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 14-15

[Article by Honored Military Pilot USSR Lt Gen Avn I. Zheleznyak and Candidate of Historical Sciences Col Yu. Mantsurov: "75th Anniversary of Kacha School"]

[Text] The Kacha Higher Military School for Pilots imeni A. F. Myasnikov has been training aviation personnel for three quarters of a century. The history of this venerable school is inseparably linked with the development of Soviet military aviation. It begins with an officer school formed in Sevastopol on 21 November 1910. Two years later the school was moved to a Crimean airfield near the Kacha River. From that time forward pilots affectionately called the school Kacha and called themselves Kachintsy.

The career of many world-famous pilots is linked to this school. Distinguished pilot M. Yefimov, of working-class origin, who established many world flying records for endurance and distance, was one of this aviation school's first instructors. Future military pilots were also taught by M. Komarov, M. Zelenskiy, Ye. Rudnev, G. Piotrovskiy, B. Matyyevich-Matseyevich, and others. The first long-distance flights by Kachintsy D. Andreadi and V. Dybovskiy demonstrated to the entire world the great skill of Russian aviators and their ability to operate in the most difficult conditions. The spin was conquered by distinguished pilot K. Artseulov, a Kacha instructor.

A total of 609 pilots were trained at the Sevastopol school prior to the Great October Socialist Revolution, including 233 enlisted personnel. The majority of these, together with progressive officers who went over to the side of the people, formed the nucleus of the Red Air Force, which began to be formed on the initiative of V. I. Lenin literally on the very first days of Soviet rule. Kacha alumni I. Spatarel, V. Vishnyakov, G. Sapozhkov, B. Tsvetkov, F. Astakhov, I. Petrozhitskiy, and many others displayed selfless courage and a high degree of flying skill in combat against the interventionists and White Guard.

The aviation school resumed operations in November 1920, following the liberation of the Crimea by the Red Army from Vrangel's White Guard forces. The school proceeded to train aerial defenders of the world's first socialist state. Two years later the aviation school on the Kacha and Flight School No

1 (the former Gatchinskaya), located in Zaraysk, consolidated. In Jauary 1923 this flight school, by order of the Republic Revolutionary Military Council, was given the name designation First Military Pilots' School.

Things were not easy for the Kachintsy at that time. They essentially had to rebuild from the ground up. The school building had been reduced to rubble, and the airplanes were old and in need of repair. In short, there were many problems. But they could not break the fighting spirit or extinguish the enthusiasm of the future Red military pilots. Communists and Komsomol members inspired their comrades by word and personal example to carry out the tasks facing them. In spite of enormous difficulties, the training process did not halt for a single day. In March 1925 the Kacha Aviation School was conferred the name of Soviet government and party figure A. F. Myasnikov.

The school went through a period of considerable growth during the first five-year plans, when the Soviet aviation industry began to gather momentum. Komsomol took a patron status with the Air Force. A resolution of the 9th All-Union Komsomol Congress proclaimed: "The destiny of Lenin Komsomol shall henceforth be indissolubly linked with the destiny of the Air Forces of the Workers' and Peasants' Red Army." Thousands upon thousands of young people responded to the appeals: "Komsomol member, climb aboard!" And "We shall give the country 150,000 pilots!" A. Pokryshkin, I. Stepanenko, B. Safonov, D. Glinka, A. Karpov, N. Vlasov and other young men who subsequently brought fame to our homeland by their exploits in the skies of the Great Patriotic War came to Kacha during these years as a result of party and Komsomol recruitment campaigns.

In the 1930's the Kacha Aviation School became a major flight school and base facility for training pilots and instructors. The first flight training curriculum was drawn up at this school. Establishment in 1932 of the school's political section, the personnel of which accomplished a great deal to strengthen party influence on all aspects of the daily life and activities of the training subunits, fostered a qualitative improvement in the entire system of training future combat pilots and strengthening their ideological and military indoctrination. The school produced thousands of highly-skilled pilots, experts at air-to-air combat, who were dedicated to the ideals of communism and the cause of the party and people. In 1933 the Kacha Aviation School was awarded an Honorary Revolutionary Red Banner of the USSR Central Executive Committee for its successes in combat and political training.

In the mid-1930's, on the eve of the terrible ordeals of the war, the Kachintsy were astounding the entire world with their unparalleled exploits and records. In 1936 the crew of an An-25 aircraft, consisting of V. Chkalov and Kacha School products G. Baydukov and A. Belyakov, made a bold flight to North America via the North Pole. All mankind applauded the record of Soviet women P. Osipenko and V. Lomako, products of Kacha, who together with navigator M. Raskova flew nonstop from Sevastopol to Arkhangelsk. Kacha School graduates G. Kravchenko, Ya. Smushkevich, P. Dzhibelli, B. Turzhanskiy, G. Lobach, T. Kutsevalov, I. Spirin, and others displayed great skill and courage in combat against Japanese samurai, fascist air aces in the skies over Spain, and against the White Finns. B. Turzhanksiy was one of the first in the country to be awarded the title Hero of the Soviet Union, for his

conspicuous combat gallantry in Spain, while G. Kravchenko and Ya. Smushkevich were among the first twice to be awarded this coveted title.

When the Great Patriotic War began, aviators from the Kacha School also stepped forward in defense of the homeland. The names of selfless air warriors twice Heroes of the Soviet Union M. Bondarenko, Amet-khan Sultan, A. Koldunov, V. Rakov, and P. Taran are inscribed in golden letters in the chronicle of the sacred war effort. The entire world is familiar with the name of three-times Hero of the Soviet Union Mar Avn A. Pokryshkin. He was constantly studying the science of winning, collecting bit by bit the know-how of Soviet air aces and devising new tactics, the essence of which was concentrated in the formula: "Altitude-speed-maneuver-fire." A. Pokryshkin was credited with downing 59 enemy aircraft. This pilot is also famous for having developed an entire pleiad of illustrious pupils, including 30 Heroes of the Soviet Union and three two-times Heroes of the Soviet Union.

At the end of 1941, when the situation at the front was particularly difficult, pilots and instructors from the school formed a fighter regiment, which fought in the skies over Moscow. In 3 months of combat this regiment's pilots downed more than 90 enemy aircraft. Many Kachintsy gained fame during the Battle of Moscow. I. Shumilov, together with his fighting friends I. Golubin and I. Zabolotnyy, shot down 30 fascist aircraft.

The men of Kacha fought bravely in the skies over Stalingrad. Instructor pilots D. Gudkov, N. Kiselev, and S. Tanov performed aerial rammings here. Participants in the Battle of Stalingrad G. Gultyayev, Ch. Bendeliani, V. Makarov, A. Aniskin, V. Alkidov, A. Baklan, and many others were named Hero of the Soviet Union. Former Kacha student pilot Hero of the Soviet Union and Honored Test Pilot USSR P. Belyasnik had an amazing war career. He flew to Stalingrad in an airplane he had paid for with his personal savings: he contributed 30,000 rubles to the defense fund and requested that an aircraft built with this money be assigned to him. Belyasnik shot down 4 enemy aircraft in his first four days of combat at the front, and subsequently raised his personal tally of kills to 26.

Kachinets A. Khlobystov accomplished three aerial rammings in the skies over the Arctic. On 8 April 1942 he downed 2 enemy aircraft in a single engagement, both both ramming. There is a photograph of this intrepid pilot's aircraft in the museum devoted to the school's history. Part of the combat aircraft's right wing has been knocked off, an aileron is missing, and it is riddled with bullet holes. What consummate skill was required to down 2 aircraft with a single wing and then nurse the crippled aircraft back to his base!

The Communist Party and Soviet Government have highly decorated this country's oldest aviation school. It was awarded the Order of Lenin for its major contribution toward training highly-skilled flying cadres during the Great Patriotic War and in the postwar years.

The present generation of Kachintsy is proud of the fact that the school is located in the hero-city of Volgograd and that the path to the sky begins on this sacred, famed soil.

Our young people are worthily continuing and building upon the traditions of the combat veteran Katsintsy. Officer V. Nebolsin strides confidently on the right flank of socialist competition. His uncle, Jr Lt A. Nebolsin, while defending the skies over the Arctic accomplished in 1941 a feat identical to that of the aircrew of Capt N. Gastello. An aspiration to emulate Soviet heroes and a dream of conquering the skies brought the young man to our school. Throughout all his years at the school, pilot cadet V. Nebolsin displayed an example in flight and theoretical training. He served continuously as a subunit Komsomol leader. Since graduating, this young officer has continued working persistently to increase his professional flying skills.

P. Chupikov graduated from Kacha in 1940. He had a distinguished military career from pilot cadet to colonel general of aviation. He fought the enemy courageously and was awarded the title Hero of the Soviet Union. Four decades later his grandson enrolled in the Kacha School. Pilot-Engineer S. Chupikov is presently continuing active service in the Air Forces.

It is rightly said that eagles are born only in eagles' nests. The entire country is familiar with the names of graduates of our school. They have proven time and again that even in peacetime there is always opportunity for courageous exploit. The road into space trod by Pilot-Cosmonauts USSR V. Bykovskiy, V. Shatalov, and Berezovoy began at Kacha. We are proud of the fact that many postwar graduates have become well-known air-force commanders and that Kachintsy are courageously and vigilantly guarding the homeland's skies and are selflessly carrying out their patriotic and internationalist duty.

It is with gratitude that we today list the names of commanders, political workers, teachers, instructor pilots, engineers, technicians, rear services and communications specialists, of all those who by their selfless labor are making a contribution toward training pilots who are highly skilled and totally dedicated to the socialist homeland. They include officers Ya. Kruglov, V. Salatyan, V. Nemchinov, F. Bizyayev, Yu. Ilin, V. Elbakyan, G. Shtern, S. Varfolomeyev, A. Polyakov, A. Seregin, V. Solovyev, V. Poshevelya, and many others. Engaged in socialist competition to greet the 27th CPSU Congress in a worthy manner, Kachintsy are filled with determination successfully to accomplish the difficult and responsible tasks assigned to them by the party and government.

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SOLVING INTERCEPT PROBLEM ON PROGRAMMABLE CALCULATOR

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 18-19

[Article, published under the heading "Recommendations of Science Into Practical Training and Instruction," by Military Navigator 1st Class Maj V. Kostitsyn: "'Intercept'... On a Pocket Electronic Calculator"]

[Text] When preparing for a tactical air exercise one frequently is called upon to solve with a fair degree of accuracy direct and inverse air target intercept problems. In the former case one determines the point of intercept from specified target initial coordinates and direction of flight, while in the latter one must determine the target's initial position and direction of flight whereby the intercept will take place at a predetermined point.

We shall examine the mathematical algorithm for solving these problems by "turn" ("maneuver") and "intercept" guidance methods on an Electronika B3-34 programmable pocket electronic calculator. Calculations are performed in a rectangular coordinate system of X and Y coordinates (Figure 1), the origin of the axes of which coincides with the airfield from which the fighters scramble, while the X axis is placed parallel to the target's groundspeed vector but in an opposite direction.

Solution of Direct Intercept Problem, "Turn" Method

The following parameters are determined as a result of figuring this problem on a hand calculator: Xpn -- intercept point X coordinate (coordinate Ypn is equal to target initial coordinate Yo); t-pn -- time passing from moment target is located at Xo, Yo to target destruction; 1-pn + Delta 1-o -- distance covered by fighter from liftoff to destruction of target (1-pn), including distance Delta 1-o; Delta 1-o -- distance between fighter and target at moment target is impacted.

Following are the input data for calculating these parameters: Xo and Yo -- initial target coordinates, which can have both a positive and negative value or be equal to zero; Wu -- target groundspeed; Vrn -- fighter speed on level-flight segment of intercept mission; t-pn min -- minimum possible time from fighter liftoff to destruction of target; Delta t-o -- time from moment target is at point Xo, Yo to fighter liftoff; 1-pn min -- distance covered by fighter

in time t-pn min; l-o -- distance covered by fighter from moment of completion of turn to target kill; Theta -- angle of intersection of target trajectory and attacking fighter. In computations on a hand calculator one generally measures value Theta from 0 degrees to plus over minus 180 degrees. If the attacking fighter is to the right of the target, Theta is greater than 0, and if it is to the left of the target, Theta is less than 0. With a forward-quarter attack and a target aspect of 0/4, Theta=0 degrees, while in a rear-quarter attack with a target aspect of 0/4, Theta=180 degrees; R -- fighter average turn radius.

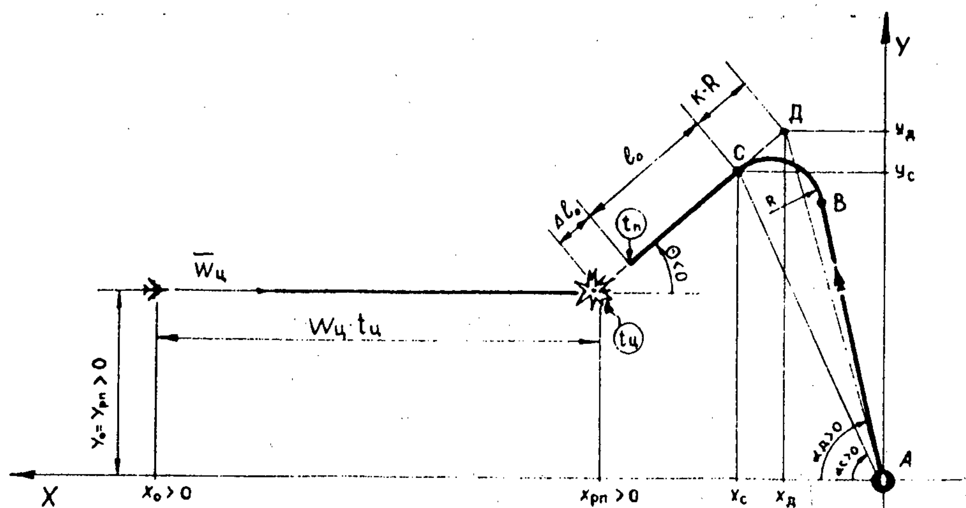

Схема решения задачи перехвата в прямоугольной системе координат.

Diagram of solution to intercept problem in a rectangular coordinate system.

The basic formulas solved on the pocket calculator are as follows:

$$t_{pn} = t_ц = t_{pn\,min} + \Delta t_o + \Delta t_{ц1} + \Delta t_{ц2} + \ldots, \quad (1)$$

$$\Delta t_ц = (t_п - t_ц)\left(\frac{V_{гп}}{V_{гп} + W_ц \cos \alpha_Д}\right), \quad (2)$$

$$t_п = \frac{(l_п + \Delta l_o) - (l_{pn\,min} + \Delta l_o)}{V_{гп}} + t_{pn\,min} + \Delta t_o, \quad (3)$$

$$l_п + \Delta l_o = АД + СД + l_o + \Delta l_o, \quad (4)$$

$$СД = k\,R, \quad (5)$$

$$K = K_1\,K_2, \quad (6)$$

$$K_1 = \operatorname{tg}\left\{\frac{\operatorname{arc\,cos}[\cos(\alpha_c - \theta)]}{\pi}\right\}, \quad (7)$$

$$K_2 = 1 + \frac{\operatorname{arc\,tg}\left(\frac{R}{AC}\right)}{90}. \quad (8)$$

Table. Utilization of Calculator Memory Registers

(1) Назначение регистра	(2) Номер регистра	(5) Тип решаемой задачи			(10) Единица измерения
		(6) Прямая задача		(7) Обратная задача	
		Метод (8) «разворот»	Метод (9) «перехват»	Метод (8) «разворот»	
(3) Запись исходных данных	1	X_0	X_0	$X_{рп}$	км
	2	$У_0$	$У_0$	$У_{рп}$	км
	3	$W_ц$	$W_ц$	0	(12) км/мин
	4	$V_{гп}$	$V_{гп}$	$V_{гп}$	км/мин
	5	$l_{рп\,min} + \Delta l_0$	$l_{рп\,min} + \Delta l_0$	$l_{рп\,min} + \Delta l_0$	км
	6	$t_{рп\,min} + \Delta t_0$	$t_{рп\,min} + \Delta t_0$	$t_{рп\,min} + \Delta t_0$	(14) мин
	7	θ	(11) Любое число	θ	(13) град
	8	$l_0 + \Delta l_0$	0	$l_0 + \Delta l_0$	км
	9	R	0	R	км
(4) Запись результата	0	$t_ц$	$t_ц$	$t_ц$	мин
	A	$\alpha_д$	$\alpha_д$	$\alpha_д$	(13) град
	B, (X)	$t_п - t_ц$	$t_п - t_ц$	$t_п - t_ц$	мин
	C	$l_п + \Delta l_0$	$l_п + \Delta l_0$	$l_п + \Delta l_0$	км

Key: 1. Register function; 2. Register number; 3. Store input data; 4. Store result; 5. Type of problem; 6. Direct problem; 7. Inverse problem; 8. Turn method; 9. Intercept method; 10. Unit of measurement; 11. Any number; 12. km/min; 13. Degrees; 14. Minutes

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Computed track l-n, covered by the fighter during flight to intercept, including distance Delta l-o, is determined with formulas (4) and (5), in which value K is such that the sum of distances AB and arc BC is equal to the sum of distances AD and CD. This calculation makes it possible to avoid problem uncertainty if the fighter airfield falls within a circle described by radius R.

The direction of fighter turn (right or left) is selected so that l-n will be the smaller. Correctness of choice of direction of turn is ensured by calculating expression arccos [cos(alpha-c - Theta)], in formula (7).

The problem is solved by the method of successive approximations. In the first approximation we assume t-pn = t-u = t-pn min + Delta t-o, determine the target's position at this moment, and calculate the time expended to target destruction at the obtained point (t-n). We then determine difference t-n - t-u and corresponding correction Delta t-u and perform a calculation in a second approximation, in which we assume t-rn = t-u = t-pn min + Delta t-o + Delta t-u1. Calculations are repeated until value t-n - t-u is less than the required computational accuracy.

Computation Procedure

1. Switch on calculator.

2. Set R/G switch to setting G.

3. Go to programming mode and enter the following program:

```
00. ИП6 01.ПО 02. Cx 03. ПП 04. 56
05. ИП9 06. ↔ 07. ÷ 08. F arctg 09.9 10.0
11. ÷ 12. 1 13. + 14. ИПА 15. ИП7 16. —
17. F cos 18. F arccos 19. F π 20. ÷ 21. F tg
22. × 23. ИП9 24. × 25. ПП 26.56 27. ИПВ
28. + 29. ПС 30. ИП5 31. ÷ 32. ИП4
33. - 34. ИП6 35. + 36. ИПО 37. ÷
38. ПВ 39. ИПА 40. F cos 41. ИП3 42. ×
43. ИП4 44. + 45. ИП4 46. ↔ 47. ÷ 48. ×
49. ИПО 50. + 51. ПО 52. ИПВ 53. с/п
54. БП 55.02 56. ИП8 57. + 58. ПВ
59. ИП7 60. F sin 61. × 62. ИП2 63. -
64./ — /65. ПС 66. Fx² 67. ИП1 68. ИП7
69. F cos 70. ИПВ 71. × 72. - 73. ИП3
74. ИПО 75. × 76. - 77. ПА 78. Fx² 79. +
80. F √ 81. ↑ 82. ИПА 83. ↔ 84. ÷
85. F arccos 86. ИПС 87. Fx≥0 88. 93
89. F ⟳ 90. ПА 91. F ⟳ 92. В/0 93. F ⟳
94. / — /95. БП 96.90.
```

4. Go to automatic mode and enter input data, guided by the table. If Vrn or Wu are specified in km/h, first convert their values to km/min. For example, when entering Vrn = 950 km/h, sequentially press the following keys: 9, 5, 0, up arrow, 6, 0, divided by, P, 4.

5. Perform calculation in the first approximation, pressing the V/0 and S/P keys. When the computation process is completed (in 50-55 seconds), value t-n - t-u will display. Analyze the obtained result:

a) if the displayed number is negative or zero, the main program computation is completed:

insert c, p. 19

To determine value Xpn, perform sequentially operations IP1, IP3, IP6, X -.

To accomplish a minimum intercept program, the fighter must execute a maneuver on segment AB (diagram), increasing the distance traveled by quantity (lpn min + Delta l-o) - (l-n + Delta l-o). Value l-n + Delta l-o is stored in memory register C;

b) if the display number is positive, compare it with the required accuracy of calculation. If it has not been reached, perform the calculation in a second approximation, pressing key S/P.

Note: If Wu > Vrn, before beginning calculations in the second and succeeding approximations, check to see what number is stored in memory register 0. If this number is less than t-pn min + Delta t-o, target intercept is not possible with the selected program.

6. After completing the calculation in a second approximation, compare the absolute value of the displayed number with the required accuracy of calculation. If it has been reached, calculate value Xpn, performing in sequence operations IP1, IP3, IP0, X -.

Value t-pn is stored in memory register 0, and value l-pn + Delta l-o in register C.

7. To perform a calculation in a third and succeeding approximations, press key S/P. In most instances difference (t-n - t-u) does not exceed 0.2 minutes in the second approximation. Less frequently this degree of accuracy is reached in the third approximation, and in virtually all cases can be reached in the fourth. With a change in input data, perform the sequence beginning with paragraph 4.

Solving Direct Problem by the "Intercept" Method

The procedure of performing calculation by the "intercept" method is the same as when using the "turn" method. One difference consists in the fact that zero is placed in registers 8 and 9, while any number may be stored in register 7. If after the first approximation the displayed number is negative, proceed with performing calculation by the "turn" method.

The value of angle alpha-d, stored in register A, can be used to determine intercept heading.

Solving Inverse Problem

An inverse problem is calculated with the same procedure in a single (first) approximation. One difference lies in the fact that the coordinates of the preselected intercept point, Xpn and Ypn respectively, are placed in registers 1 and 2 in place of values Xo and Yo, while value Wu = 0 is placed in register 3.

In performing the calculation, press keys V/0 and S/P. If a negative number or zero is displayed upon completion of the calculation,

insert d, p. 19

In order to execute a minimum intercept program, on segment AB (diagram) the fighter must execute a maneuver which increases the traveled distance by quantity (l-pn min + Delta l-o) - (l-n + Delta l-o). Value l-n + Deltal-o is stored in register C.

If a positive number is displayed upon completion of the calculation, the value t-pn is stored in register 0, while the value l-pn + Delta l-o is stored in register C.

To compute target coordinate Xo, place in register 3 the specified target groundspeed and press keys IP1, IP3, IP0, X + if t-pn > t-pn min + Delta t-o, or IP1, IP3, IP6, X +, if t-rp is equal to or less than t-pn min + Delta t-o.

This intercept calculation procedure can also be performed on other programmable calculator models. The only difference will be in the markings of certain keys.

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FIGHTER-BOMBERS HIT RANGE TARGETS THROUGH CLOUD COVER

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 22-26

[Article, published under the heading "Be Alert, In a Continuous State of Combat Readiness," by Col A. Andryushkov: "Tested by the Range"]

[Text] Fighter-bomber regiment commander Lt Col A. Zhukovin reported to the commanding general of district air forces in a precise and confident tone: "Personnel are preparing for a tactical air exercise. The level of air, weapon, and tactical proficiency of pilots and tactical control officers gives us capability successfully to accomplish mock combat missions."

Honored Military Pilot USSR Col Gen Avn I. Dmitriyev listened attentively to his report and expressed his satisfaction with the state of affairs. The commanding general had long followed the practice of arriving at units unannounced for a surprise inspection. Now the fighter-bomber crews would be taking a tough examination. According to reports from his deputies and district pilot-inspectors, things were going fairly well overall in the regiment but, as they say, it is better to see for yourself....

The commanding general was pleased with the young regimental commander's confidence in himself and his men, grounded on detailed knowledge of the situation in the subunits: the aircraft were in a state of continuous combat readiness, a healthy morale prevailed in the suqadrons, and the level of the men's professional knowledge and skills was fairly high. He could also sense this from the calm, businesslike tone of the report. Everything indicated a good beginning to the job being done by Lieutenant Colonel Zhukovin, who had fairly recently assumed the duties of regimental commander. Well, the following day would tell what results the aviation personnel had achieved.

A difficult test awaited the collective: a tactical air exercise for one of the squadrons with a comprehensive testing of tactical performance at the range. This would enable them to determine how effectively they were conducting the scheduled training of aviation personnel and how prepared Zhukovin himself was, as well as testing his ability proficiently to organize mock combat operations for his men on a tight timetable.

Lieutenant Colonel Zhukovin had gathered together his deputies, squadron commanders and commanders of supporting subunits and, discussing with them how best to organize things, refined and detailed the assigned exercise task.

"One squadron will be working at the range, but all squadrons shall be ready and prepared," he stressed.

Final instructions were given and executing personnel were specified, as well as the responsibility of each for the assigned task.

An open party meeting was held in the unit. It was of short duration, just like in actual combat conditions. Items were addressed in an incisive and concrete manner at this meeting. Everybody was cognizant of the difficulty and complexity of the forthcoming test and knew that successful accomplishment of air missions depended on the conscientiousness of all aviation personnel.

In this regiment they have an implacable attitude toward the slightest instances of unnecessary situation simplification or unnecessary relaxation of demands in combat training. The subunit commanders take pains to ensure that an environment maximally approximating actual combat is created during each and every training sortie.

District inspectors military pilots-expert marksmen Cols N. Chaga, V. Napalkov, and Ye. Alpatyev were extremely helpful in accomplishing precise organization of effective and efficient personnel combat training. One of the requirements on which they insist is that training activities be integrated. If, for example, pilots work on flying techniques in the practice area, they subsequently transition to air-to-air combat, which tactical control officers handle in radar guidance mode. Bombing on the ranges is combined with aircraft-cannon gunnery, and so forth. Each training sortie is later analyzed and critiqued in detail, and performance results are totaled up. The best pilots for the month, quarter, and period of training are determined. This approach to combat training motivates innovation and increases each man's feeling of responsibility for the overall success. And in all things the pace is set by party members and veteran personnel.

...The crew alert was sounded at dawn. Military Pilot 1st Class V. Shklyar scrutinized the bus interior as if it were a cockpit, by habit from left to right. All flight personnel were present.

"Go!" he said to the driver and, in order not to waste time, proceeded to detail the sequence of departure of two-aircraft elements. "Major Roslyakov and Captain Krokhmalyuk go first. Mission: recon and knock out 'enemy' air defense assets. Captain Molchanov and Senior Lieutenant Sokhnenko head for the CAP zone over the range to cover the ground strike aircrews. Engage any 'enemy' fighters which appear. Report immediately when turned around and ready to go."

It took the pilots only a few minutes to don their protective gear. The aircraft technicians, who had come out to the airfield earlier, were completing final preflighting procedures on the aircraft.

Maj Yu. Roslyakov, deputy commander of the 1st Squadron, directed his gaze skyward: there was something out there of a whitish color rolling in from the direction of the river -- it was either a fog bank, or the horizon was obscured by morning haze.

"Looks like some weather moving in," commented Capt G. Krokhmalyuk, who was standing alongside, noting his concern.

"The weather is not so good; you'll have to be alert. Don't get too close to your partner's wingtip, but don't open up too much either. You may have to go straight in on your target run...."

At this moment the aircraft technician, Capt A. Baburin, walked up to the pilot and announced: "Comrade Major! Your aircraft is ready to go. Full fuel load, standard armament load!"

Roslyakov greeted him, shook Baburin's hand and, glancing at the pentagonal Excellent-Rated Aircraft symbol, ducked under the fuselage, heading for the nose gear. That is the procedure: no matter how much in a hurry a pilot may be, he must personally take over custody of his aircraft from the technician. Squadron deputy commander officer Roslyakov has served as a member of the limited Soviet forces in Afghanistan, and he is well familiar with the value of flawless performance by all aircraft systems and equipment.

Capts G. Krokhmalyuk and Kh. Akhmetov also completed the walkaround inspection of their aircraft.

The first pair bettered performance standards in readying for departure. The command was immediately given: "Go!"

The stillness was shattered by the roar of jet engines. The men on the ground followed the bright dots with their gaze as they disappeared over the horizon.

As the weather forecasters had warned, the target area was covered by a solid overcast. Major Roslyakov sensed rather than saw that his wingman was maintaining the proper lateral and forward spacing. With such tight formations it is more difficult for the "adversary" to determine the number of aircraft in a group, and each pilot can assist his comrade.

Roslyakov time and again saw proof of the reliability of such formations -- about which his father, a pilot in the war, had told him and his brother, also a military pilot -- when he was flying escort duty protecting transport aircraft carrying food supplies in the skies over the Democratic Republic of Afghanistan. Just as the Fascist antiaircraft gunners had done during the Great Patriotic War, the dushman [rebels] attempted to hit the trailing aircraft, so that it could not alert the other aircraft positioned out ahead.

They broke out of the clouds precisely on target. Major Roslyakov had decided to employ tactics of penetrating "hostile" air defense by a two-ship element which he had devised with his wingman and which had been approved by the regimental methods council. Captain Krokhmalyuk was the first to spot an "enemy" missile launcher.

"551! Target... degrees left, range...."

"I have it in sight!" replied Roslyakov and ordered: "I'm going in! Cover me!"

Guided missiles streaked from the pylons of the lead aircraft and headed toward the target. Krokhmalyuk was about to fire his own missiles to finish the job on the missile site when he suddenly spotted beyond the treetops the telltale signs of radar vans. This was the heart of the target's air defense.

"Target ahead, 30 degrees! I'll get him!" he radioed the leader.

Major Roslyakov rocked his wings and broke away.

Captain Krokhmalyuk put his pipper on the target and fired several missiles. The antennas disappeared in a burst of flames.

The main thing had been accomplished. Executing a chandelle, the two fighter-bombers released parachute flares over the range. Clouds and ground were bathed in a blindingly bright light. The flares presented the approaching strike aircraft with a reference point which was visible for quite some distance.

The range flight operations officer, Lt Col I. Miroshnichenko, radioed: "Aircraft cleared onto the range! Bombing with coordinates as specified!"

Each type of weapons delivery on the range is compicated and specific in its own way. It is no simple task to hit point targets with missiles or to hit targets with cannon fire and bombs involving vertical maneuver during attack-pass pullout -- precision flying and aiming are required. Nevertheless special training and preparation, particularly in a psychological respect, are required to hit ground targets from above cloud cover, so-called blind bombing.

The difficulties are due chiefly to a lack of visual contact with the target. This places a definite imprint on the nature of a pilot's actions. It is possible to hit a ground target out of visual contact with minimal point of impact error only with a high degree of smoothness and precision on the part of a great many aviation specialists as well as complete confidence in the accurate and failure-free operation of the equipment, for automatic control does not replace but merely assists the human operator. And under the guidance of the veterans, particularly Col Ye. Alpatyev, many of the regiment's pilots have successfully mastered this type of ordnance delivery as well. Today it is up to them to confirm their high degree of proficiency with practical deeds.

Col Gen Avn I. Dmitriyev could see from his observation post the outlines of targets positioned on the range. His experienced pilot's eye noted both the uniqueness of the camouflage, where more careful scrutiny showed a presumed tank to be a tree with a shaped crown, and features in the camouflaging of personnel shelters which made it difficult to determine the principal target.

The low cloud cover also made conditions on the range more difficult, but in an actual combat situation the enemy will employ the most sophisticed methods and means of concealing his men and equipment.

"553 on final target heading! Request clearance to attack." The range officer recognized the voice of the leader of the second pair, squadron executive officer Maj A. Malykh. He, the regiment's best pilot, and his wingman, flight commander Capt A. Andryushchenko, had on numerous occasions bombed ground targets through cloud cover. The rest of the men would measure their performance against these two.

A roar swept over the range. There were no aircraft to be seen. Suddenly large droplet-like objects emerged from the clouds and descended earthward, growing larger as they approached. These were aircraft bombs heading for their targets. Thick black clouds of smoke and dust erupted at their point of impact, and logs and twisted reinforcing rods were thrown into the air.

Fighter-bomber pairs swept over the range one after the other. The winged Communists kept their word. The strikes were accurate....

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NEW BOOK ANALYZES WORLD WAR II AND ITS CONSEQUENCES

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) p 27

[Review, published under the heading "Assisting the Propagandist," by Lt Col N. Shakhmagonov of book "Vtoraya mirovaya voyna: itogi i uroki" [World War II: Results and Lessons], Voyenizdat, Moscow, 1985, 447 pages: "World War II: Results and Lessons"]

[Text] The Military Publishing House of the USSR Ministry of Defense has brought out a new book dealing with the results of the most devastating war in the history of mankind. This solid study reveals the causes and nature of the war, other important problems and issues, and sheds light on events in all theaters.

The authors show in a vivid and multifaceted manner the decisive role played by the Soviet Union in the defeat of German Fascism and Japanese militarism as well as Communist Party activities aimed at unifying the people and mobilizing all resources to repulse the enemy. This book synthesizes the important military-political results of World War II and exposes bourgeois falsifiers of history. The authors note that the historical truth is the fact that it was the Soviet people, led by the Communist Party, which blocked the path of German Fascism toward world domination, bore the brunt of the war on its shoulders and made a decisive contribution to the achievement of victory.

In the first section of the book -- "Origin and Course of the War" -- one finds a profound analysis of the international situation on the eve of the war, with discussion of war preparations by German Fascism and Japanese militarism -- the shock forces of world imperialism. The authors expose the policy of Great Britain, France, and the United States, which were encouraging the aggressors in their desire to go to war against the Soviet Union. The facts presented in this section remind us that we must engage in a persistent and purposeful struggle against any and all manifestations of militarism and fascism. They attest to the fact that unity of the worker class and of all progressive mankind is essential in order successfully to prevail against war. The book's authors emphasize that it is necessary to struggle against war before it starts.

The next section, titled "Sociopolitical Results of the War," deals with analysis of the sociopolitical conditions and factors of the victory over fascism, the struggle by the masses, the Resistance movement and the antifascist underground, and the contribution of the United States, Great Britain, France, and other countries toward the overall victory over the enemy. The authors synthesize the experience of political and military cooperation between nations with differing social systems within the framework of the anti-Hitler coalition and demonstrate the total collapse of the political systems and ideology of fascism and militarism.

In the chapter titled "World-Historic Victory of the Soviet Union and Antifascist Forces in World War II," the authors tell about that enormous contribution which was made by the USSR at the concluding stage of the war toward achieving victory over militarist Japan, defeating in detail the powerful Kwantung Army in August 1945, as well as the assistance rendered by the Soviet Union to the peoples of Central and Southeastern Europe. Approximately 7 million Soviet fighting men took part in liberating 11 European countries with a total area of 1 million square kilometers and a combined population of 113 million.

The section titled "Economic Results of the War," the authors synthesize the results of the economic contest between the nations which took part in the war and present the decisive role of the USSR economy in achieving victory, and the superiority of the economic system of socialism over the capitalist system. The authors also examine problems of economic support of the war effort by the bourgeois countries of the anti-Hitler coalition, the militarist nature of the economy of Germany and Japan and the reasons for the economic defeat of these countries. In particular, the authors present figures on the aggregate material costs of preparation for and conduct of the wars which took place in the first half of the 20th century (including World War II), as well as the costs of postwar recovery. These costs total 4,700,000,000 dollars. The overwhelming bulk of this total -- 4 trillion dollars -- went for World War II. The Hitlerite invasion inflicted enormous loss on the Soviet Union -- almost 41 percent of total losses suffered by all countries which took part in this war.

Of particular interest to the military reader are the materials contained in the section "Armed Forces and Military Art." In this section the authors discuss the armed forces of the opposing sides, direction of combat operations, and the conditions of accomplishment of a radical turning point on the Soviet-German front -- the main battlefront of World War II.

The authors point out that the principal strategic objective -- defeat of the fascist army -- was achieved by sequential accomplishment of a number of strategic tasks by the Soviet Armed Forces. In the 1941 summer-fall campaign, the Soviet Army thwarted Hitlerite Germany's offensive plans, halted and wore down the enemy's army in defensive battles. The most important strategic result of this campaign was the collapse of Operation Barbarossa -- the aggressor's principal strategic plan.

The Soviet Army's victory at Moscow marked the beginning of a radical turning point in the struggle against the Hitlerite invaders, exerting considerable

influence on the entire course of World War II as a whole. It eliminated the threat of invasion of Britain by the Fascist hordes, strengthened the position of supporters of an antifascist policy in the United States, forced Japan's ruling circles to revise their plans to attack the USSR, helped give a boost to the liberation movement of the peoples of the occupied countries and to unite antifascist forces. And our army's victory at Stalingrad signified a total and final shifting of the strategic initiative over to the Soviet Armed Forces.

The most important strategic result of the Battle of Kursk, the authors further note, was the thwarting of the plans of the Fascist command authorities to retake the strategic initiative and to alter the course of events on the Soviet-German front in their own favor. The offensive strategy of the Wehrmacht suffered total defeat in the Battle of Kursk. From that moment on strategic defense was the principal type of operation conducted by German-Fascist forces right up to war's end.

The authors show the unfading significance of the Soviet Army's victories in 1944 and 1945.

In the concluding section -- "Lessons of the War and the Present Day" -- the authors investigate the fundamental problems of the postwar years, the influence of the results of the war on change in the correlation of forces in the world arena in favor of socialism and on transformation of the world socialist system into a decisive factor of historical development.

The authors note that the problem of preventing war and preserving world peace is the most important problem of the contemporary era. Political and social changes which have taken place in recent decades -- establishment of a world socialist system, growth of the communist and worker movement, the collapse of colonialism, weakening of the position of capitalism, as well as increase in the number of supporters of peace -- have created realistic preconditions for solving this vitally important problem.

There still exists the danger that a new center of conflagration will blaze up, however. "International development has reached a point beyond which one cannot advance without making highly responsible decisions directed toward bringing a halt to the arms race and stopping the slide toward war," it was emphasized at the October (1985) CPSU Central Committee Plenum. "These decisions cannot be put off without risking losing control over the dangerous processes which threaten the very existence of mankind. Holding in check the forces of militarism and war and ensuring a solid peace and reliable security constitute the root problem of the contemporary era." The authors also expose war as the greatest evil. This volume will be very helpful to command personnel and political workers as well as to the propagandist body of activists in teaching and indoctrinating the armed defenders of the Soviet homeland.

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EFFECT OF ASSOCIATED MASS ON AIRCRAFT CONTROLS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 32-33

[Article, published under the heading "Practical Aerodynamics for the Pilot," by Military Instructor Pilot 1st Class Candidate of Technical Sciences Lt Col N. Litvinchuk: "Effect of Associated Mass"]

[Text] In the course of practical flying activities there sometimes arise questions to which unequivocal answers cannot always be given. For example, one cannot satisfactorily explain such phenomena as "spontaneous" rearward displacement of the controls during maneuvering, with a properly functioning control system, accompanied by loss of airspeed, exceeding maximum allowable G forces and initiation of stall, as well as "sticking" of controls (they have been discussed in this journal). Such phenomena also include involuntary G force "grabs" on aircraft, cessation of G force "grabs" and longitudinal oscillations in angle of attack when the pilot releases the controls, plus others.

Frequently flight personnel perceive such phenomena as aircraft malfunctions or attribute them to unsatisfactory aircraft stability and controllability characteristics. On the other hand, specialists blame errors in pilot flying technique. Thus opposing points of view clash, and in most instances the resulting decisions do not favor the human operator, since the equipment proves to be in good working order.

Analysis indicates that some of these phenomena occur due to peculiarities of interaction between man and machine. And differences arise due to differing opinion between pilot and expert regarding aircraft stability and controllability.

It is believed, for example, that such a longitudinal controllability characteristic as G force gradient P-v-n-y is determined for irreversible control systems by the characteristics of the load-applying mechanism. The pilot defines this characteristic not only with the load-applying mechanism but also friction forces in the control linkage, which increase with increased accelerations, and inertial forces which arise due to a weight imbalance in the control system mechanical linkage from the valve of the control surface

drive to the control lever, including the latter, as well as the influence of the so-called associated-mass effect.

The substance of the effect is shown in Figure 1 (back cover) [not reproduced]. If the pilot holds the control stick, there takes place a weight imbalance of the "pilot-manual control system" circuit by that part of the body which is interacting with the control stick. The pilot's associated or virtual mass is determined by his weight and build, his position in the cockpit, his gear, and the specific features of his action on the control stick. In conditions of linear and angular accelerations, the tangential component of inertial forces from the weight imbalance introduced by the pilot is not felt by him, but it leads to additional displacement of the control stick, change in perceived forces on it and their G force gradient.

Figure 2 (back cover) [not reproduced] contains calculated values of forces and their load factor gradients for a standard maneuverable single-seater aircraft with a servo power-unit control system, executing a maneuver at a constant airspeed. The weight of the pilot's hand was adopted as disbalance introduced by the pilot. Friction forces in the control linkage and the influence of control linkage disbalance were ignored in these calculations. It is apparent that there are substantial differences between the control characteristics designed into the loading mechanism and those perceived by the pilot.

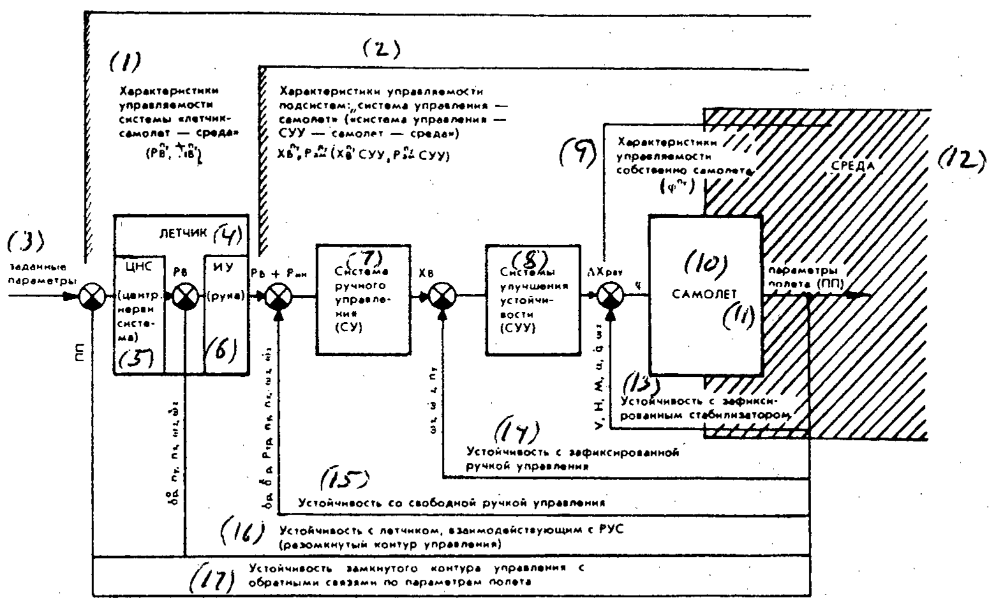

Figure 1. Classification of longitudinal stability and controllability.

Key: 1. Controllability characteristics of the "pilot-aircraft-environment" system; 2. Controllability characteristics of the following subsystems: "control-aircraft system" ("control-stability enhancement system-aircraft-environment system"); 3. Prescribed parameters; 4. Pilot; 5. Central nervous system; 6. Hand; 7. Manual control system; 8. Stability enhancement system;

(Key to Figure 1 on preceding page, cont'd) 9. Controllability characteristics of aircraft proper; 10. Aircraft; 11. Flight parameters; 12. Environment; 13. Stability with set stabilator; 14. Stability with set control stick; 15. Stability with free control stick; 16. Stability with pilot interacting with control stick (open control loop); 17. Stability of closed control loop with flight parameter feedback linkages

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One can specify by magnitude of perceived characteristics (Figure 2 on back cover) regions of acceptable and less acceptable conditions of flying performance, load factor neutralness, as well as a region of occurrence of load factor instability of the "pilot-aircraft-environment" system, in which there can occur "spontaneous" rearward movement of the control stick, accompanied by exceeding the maximum allowable G forces, involuntary G force "grab," or exceeding the maximum allowable angle of attack. This applies in particular to experienced pilots, who utilize noninstrument information to a greater extent during flight. On dual-control aircraft the effect of associated mass is manifested to a greater degree, while the specified regions displace in the direction of smaller G forces.

The presence of stability enhancement systems (SUU) in the control loop, that is, automatic stability and damping devices, also affects controllability characteristics.

The combined effect of perceived forces of pilot and "interference," including inertial forces from the disbalance introduced by the pilot, causing control stick displacement, deforms the loading mechanism spring. Therefore one cannot determine by control stick displacement what perceived muscular forces were applied to it while flying the aircraft. Utilizing the trimmer effect mechanism (MTE) and onboard recording devices, one can accomplish separation of these forces, replacing perceived forces on the control stick, in conditions of acceleration, with MTE forces, with subsequent brief freeing of the control stick.

A like situation applies to another static characteristic of longitudinal controllability -- G force stick displacement gradient. This gradient additionally includes free play and slackness in the control system linkage. These controllability characteristics are connected with thresholds of sensitivity of the human operator to forces and displacements which are determined by many factors of flight.

The effect of "interference" on control can be traced in the diagram contained in Figure 1, which presents a classification of types of stability and controllability of the "pilot-aircraft-environment" system as applied to short-period longitudinal motion. This diagram includes a well-structured theory of aircraft G force pitch stability with set stabilator (the aircraft's intrinsic dynamic properties) and with set control stick, an insufficiently developed and to a lesser degree acceptible theory of stability with free control stick, as well as a theory of stability, little known to flight personnel, taking into account the pilot holding the control stick without generating control effects (open control loop). This latter type of stability

is the most general with manual control of an aircraft, since the pilot continuously holds the control stick during flight.

The above-enumerated types of stability differ one from the other in the fact that during operation of SUU, occurrence of weight imbalance of the control system linkage, free play, control linkage elasticity, and especially with the effect of inertial forces of weight imbalance introduced by the pilot, in conditions of linear and angular accelerations, there occurs additional displacement of control levers, and consequently the stabilator as well, which is equivalent to displacement of neutral center of gravity and change in reserve longitudinal G force static stability. These kinds of stability can differ substantially from an aircraft's intrinsic dynamic properties, including with operating stability enhancement systems.

In Figure 2 calculated values are given, in normal load factor and airspeed coordinates for a single-seater aircraft, of a region in which the "pilot-aircraft-environment" system is statically G force unstable and where "spontaneous" rearward movement of the control stick is possible. This region, however, is not clearly marked, since it depends on many factors, particularly on the pilot's position in the cockpit, the characteristics of the manual control system, and operation of stability enhancement systems and trim effect mechanism.

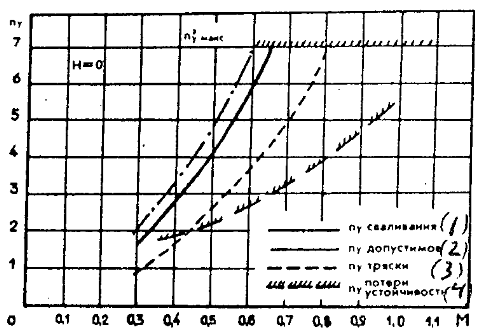

Figure 2. Characteristic regions and flight conditions.

Key: 1. Stall; 2. Allowable; 3. Flutter; 4. Loss of stability

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Calculations indicated that a G force stable aircraft with a pilot interacting with the control stick may possess oscillatory or aperiodic instability. Closing the control loop, the pilot cannot always ensure its stability, especially in an oscillatory respect.

Thus the term stability of the closed "pilot-aircraft-environment" system control loop is defined as the system's capability independently, without control actions by a human operator, to return to an initial state of equilibrium following random deviations caused by minor, temporary disturbances. Controllability of a given system, including as regards angle of attack, should be defined as that system's capability to respond appropriately to the pilot's control actions. Perceived muscular forces are

the principal control actions. Consequently, stability of a closed control loop is the capability of the "pilot-aircraft-environmwent" system, with control actions being applied by the pilot, to maintain specified conditions or to return to these conditions when they are disrupted due to any external cause.

At the present time, when considering stability and controllability, they are usually divided into static and dynamic respectively. Pilots more easily grasp a different approach, however, whereby both stability and controllability are viewed as a single whole, correspondingly with static and dynamic characteristics. I believe the latter approach is closer to the pilot's perception.

We must briefly discuss the reasons for the existence of the two above-mentioned views on aircraft stability and controllabiilty. Why did such a situation arise? Evidently this is a result of the machine-centered approach which is dominant at the present time, whereby man constitutes an elementary link incorporated into the control loop. The anthropocentric approach, however, developed by Soviet scientists, views man as the main component of a control system, organizing its functioning. With this approach unquestionably those characteristics which he perceives should be adopted as controllability characteristics. The pilot judges the aircraft's stability and controllability by its behavior and his own sensations.

Proceeding from this, conclusions pertaining to control of maneuverable aircraft suggest themselves, in particular countering the effect of associated mass. One must consider the effect of "interference" in control when flying with high G forces. Even experienced pilots should get their bearings not only from noninstrument information but should also make use of instrument information sources, including angle of attack indicator, and not allow involuntary rearward movement of the controls.

When flying in a two-seater aircraft, participation by two persons simultaneously in controlling the aircraft increases the probability of rearward movement of the control stick. Therefore the instructor's readiness to intervene in control of the aircraft when instructing a student pilot in flying (maneuvering) technique should not be accompanied by continuously holding his hand on the control stick. Another reason why this is necessary is because in this instance the student pilot feels the instructor's constant intervention in controlling the aircraft. When parrying overcontrol, the instructor pilot should push the control stick forward, without tightening his hand and without holding the stick in a fixed position.

During maneuvering one should not loosen the restraining straps and lean forward when G forces are being generated, especially during dive pullout when attacking ground targets. When G force "grab" occurs, when the pilot cannot push the control stick forward, he should release the stick until G forces diminish, and after this continue control procedures. Cases have been noted where a pilot's hand has been torn from the control stick under the effect of G forces, and "grab" immediately ceased.

The control stick must be held in place if longitudinal oscillations occur. If the oscillations do not stop, it is desirable to put the aircraft into a climb and to release the control stick for 2-4 seconds.

All these recommendations have been confirmed by practical flying experience. We should stress that not every hazardous phenomenon in flight is a result of the occurrence only of "interference" in control. Some dangerous phenomena can be caused by equipment malfunctions, external influences, pilot error, as well as by simultaneous occurrence of a group of the above-enumerated factors.

In conclusion we should note that analysis of stability and controllability of the "pilot-aircraft-environment" system is much more complicated than analysis of the dynamic properties of the aircraft proper, where comparatively simple analytical expressions can be used. It requires using a computer, which is not only possible at the present time but is also a demand of the time and a practical demand as well.

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PILOTS CONTROL FATIGUE, STRESS WITH AUTOSUGGESTION

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 34-35

[Article, published under the heading "Flying and Psychology," by Candidate of Medical Sciences Col Med Serv S. Melnik and Candidate of Medical Sciences Maj Med Serv A. Shakula: "Have the Ability to Control Yourself"]

[Text] Most frequently the skill of a combat pilot is viewed as a solid fusion of knowledge of the aircraft, aerodynamics, and job-related skills. As practical experience shows, however, this is far from the entire picture, especially in present-day conditions. Today a pilot should possess the ability aggressively to mobilize all his inner forces -- power of attention, will, memory, and other psychophysiological qualities. As an aggregate this comprises the basis of a high degree of aviator combat readiness and fighting efficiency and, consequently, flight safety as well. At the present time the training and indoctrination process is constructed with the aim of purposeful forming and shaping of solid knowledge and skills which affect the job proficiency of flight personnel. A very important role is assigned to instilling ideological conviction, patriotism, and devotion to the homeland.

The flying profession places very high demands on a person's psychological qualities. In connection with this, it is important to teach a pilot the ability to control his own state of mind in any and all conditions. There are techniques and methods available which help one raise one's fighting spirit at the proper moment, help stimulate working efficiency in a condition of marked fatigue, help remove neuropsychic stress and efficiently expend psychophysiological reserves during flight. As Hero of the Soviet Union Col Gen Avn M. Gromov stated, in order to fly with reliability it is very important to know how to control the aircraft, but it is even more important to know how to control oneself. Since the level of development of modern aircraft and the complexity of assigned missions are very high, this statement by an eminent pilot is becoming even more relevant today.

The method of psychosomatic self-regulation is an extremely important element in the arsenal of psychogenic means of controlling one's psychophysiological state in order to maintain the health and increase the working efficiency and stamina of flight personnel, and to extend one's flying career. It consists of modified autogenous conditioning according to I. Shults, the verbal

formulas of which are divided into separate lessons which pursue a specific purpose. The verbal formulas of all lessons are contained in an article by L. Grimak and Yu. Isaulov entitled "Controlling Mood" (AVIATSIYA I KOSMONAVTIKA, Nos 1-3, 1979).

The first two lessons, for example, are aimed at achieving muscular relaxation by picturing the sensation of heaviness (the arms in the first lesson, the legs and trunk in the second). The third and fourth lessons are for the purpose of developing skills in voluntary dilation of blood vessels by picturing warmth in various parts of the body. Subsequent sessions prescribe respectively improvement of skills in voluntary control of breathing, development of the ability to cause dilation of blood vessels in the region of the solar plexus and abdominal cavity with the aid of sensations of heat, instruction in controlling the rhythm of heart contractions and control of vascular reactions in the region of the head. All lessons are recorded on tape.

Flight personnel are instructed by a doctor who has mastered the method of psychosomatic self-regulation and who is familiar with the specific features of its application in practical flying activities. Instruction is given in a quiet setting, in a group or individually. Students are placed on chairs with eyes closed in the "coachman" position, less frequently semireclining in an armchair or lying on a couch. The body weight without muscular tension is transferred to the ligamentous structure of the spinal column.

Twenty-four sessions are devoted to mastering the general part of the course, three sessions for each lesson. Class sessions are conducted during preliminary preparation for flight operations at one-day intervals, with mandatory daily independent student repetition in one's free time (just before bed or during preflight rest). After each 15-20-minute session the student fills in a daily log, where he puts down a complete description of the various sensations he has autosuggested, specific features of these sensations, as well as the date and time of the session. Maintaining such a daily log, the pilot becomes accustomed to self-observation and self-monitoring of his funtional state. After 6-7 weeks of regular sessions, he masters certain skills, on the basis of which he subsequently, over the course of 2-3 weeks, assimilates the exercises of the specialized part of the course.

The principal tasks of this stage of training consist in mastering three variations of the psychosomatic self-regulation method: autogenous relaxation, autogenous stimulation, and relaxideomotor training. The first variation consists of formulas of autosuggestion of heat, heaviness, and calming during excessive neuropsychic tension, the second consists of formulas of autosuggestion of activeness, cheerfulness, and freshness during phenomena of fatigue, while the third consists of picturing the sequence of work performance operations when preparing for or during a training flight. In the latter case the sequence of control actions is mentally played against the background of a special phase state (similar to a hypnotic state), caused by autogenous relaxation. Favorable conditions are created for accelerated mastery of job-related skills.

After mastering the general and specialized parts of the psychosomatic self-regulation method, one can proceed with its application in practical flying activities. For this one mentally goes through a flight assignment in the process of preliminary preparation, against the background of autogenous relaxation. The functional state is then activated with the aid of the previously-mastered appropriate autosuggestion formulas. Just before bed one mentally goes through the forthcoming flight again against the background of autogenous relaxation, instilling confidence in one's ability and excellent performance of the flight.

Approximately 20-30 minutes before takeoff, one mentally goes through the most complicated and critical phases of the training sortie against the background of autogenous relaxation, after which activation of the organism is accomplished. On a long training mission, 20-30 minutes before weapons delivery or landing, one mentally goes through the forthcoming procedures in the same manner, under the condition that the job duties of one crew member, with the permission of the aircraft commander, are handed over to another crew member for 5-7 minutes. When a feeling of tiredness occurs on a long flight, the autogenous stimulation variation should be used. Upon completion of a flight, calming, soothing formulas are autosuggested, for the purpose of relaxing excessive neuropsychic tension and speeding recovery of functional state.

The high degree of effectiveness of the psychosomatic self-regulation method has been confirmed by research conducted in laboratory conditions, on the flight simulator, and during actual flights by line-unit aircrews. We should note that accuracy of bombing and tactical missile firings was 25-50 percent higher. Results of extended observation of a group of flight personnel in a long-range bomber unit which had mastered the method of psychosomatic self-regulation indicate that work losses due to sickness during the first year following training in this method were less by a factor of 1.8, while during the second year they decreased by a factor of 3 in comparison with the control group. A positive effect is also noted in flying technique and navigation performance, with fewer errors by flight personnel and fewer air mishap threatening situations.

We have received positive feedback on utilization of psychosomatic self-regulation. It can help one easily reduce overall stress and tension and get into a mood of promoting higher-quality task performance. In the opinion of many pilots, training classes to master the method of psychosomatic self-regulation are a necessary thing, since it enables one substantially to reduce the feeling of fatigue, to increase working efficiency, helps master the training curriculum, and diminishes stress and tension, particularly on long flights.

At the present time this method is being used increasingly more extensively in the units in preparing for flight operations, at the initiative of commanders

and flight surgeons, which is having a positive effect on the health and working efficiency of aircrews. Clearly thought should be given to the possibility of incorporating into the combat training schedule specialized measures which help master skills in psychosomatic self-regulation.

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SOLID TRAINING FOR AIRCRAFT MAINTENANCE PERSONNEL

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 36-37

[Article, published under the heading "They Support Flight Operations," by Gds Capt A. Lukashenya, routine inspection and maintenance group chief: "The Point Is Not Intuition...."]

[Text] Recently I was present during a conversation between two technicians about professional intuition. They were recalling with unconcealed delight incidents from the experience of a colleague from their regiment, aircraft technician officer V. Saverin, where he had intuitively and very accurately determined by engine sound a malfunctioning assembly or failed aircraft component.

I am well acquainted with Gds Sr Lt V. Saverin, one of our squadron's best technicians. Time and again I have heard comments by command personnel and colleagues to the effect that this officer is an expert at his job, capable of detecting literally by some sixth sense the slightest changes in the operation of fighter systems and components. Typically, however, it is the young aviation engineer service specialist personnel who are enraptured over Saverin's professional intuition. Those who are a bit older and more experienced know well that an aviation technician's intuition is nothing other than a solid fusion of profound knowledge of theory and practical experience. And practical experience confirms this conclusion. Here is one of the numerous examples which characterize officer Saverin's labor.

Once, just prior to a training sortie departure, the aircraft technician was standing on the cockpit ladder, verifying cockpit canopy closure. The pilot signalled to him with a gesture that everything was just fine and that he should get him ready to taxi. Saverin took his time, however. Before climbing down, he once again visually inspected the aircraft from his high vantage point, and then by habit placed the palm of his hand on the point of juncture between the fixed and movable part of the canopy. He suddenly felt a barely-noticeable unevenness. The aircraft specialist pricked up his ears, because he knew that this could mean that the cockpit was depressurized. But the technician had seen the pilot open the pressurization valve. This meant there was a problem....

The aircraft's departure had to be delayed. A closer inspection revealed that the cockpit pressurization hose was damaged. After the problem was corrected, the combat jet was released for its training sortie.

Analyzing this incident, can we state that the aircraft technician displayed any special intuition? I think not. It is simply that this maintenance specialist was thoroughly familiar with the features of design and construction of the aircraft he serviced, in particular the closure feel of the aircraft canopy with pressurization valve open and shut. In addition, in the process of servicing and maintenance, Saverin had developed to a state of automatism the habit of checking every little thing before releasing the aircraft for a mission, including checking with the palm of his hand for any dislocation of the surfaces of the fixed and movable parts of the canopy.

Repeatedly performing the same operations on an aircraft, aviation engineer service specialists in time gain a clear understanding not only of the specific order and sequence of their actions but also the structural positioning of each and every part, assembly, and component. For example, an experienced technician can determine, even without looking at the index marks, whether there is sufficient pressure in the landing gear shock absorbers, whether the gear door actuating rods are bent, plus many other things.

Once, while inspecting the main gear, senior airframe and powerplant mechanic WO V. Berezhnoy discovered a break in a hydraulic system line hoseless connection. He did not spot it on the basis of a primary but rather a secondary indicator: several rivets had sheared on the hydraulic line connector flange.

Later Berezhnoy, sharing his know-how with his comrades, related that when he works in the equipment bays, inspection openings, and landing gear wells, he usually inspects not only the part or assembly proper but also everything around the assembly accessible to visual inspection. It was this habit, established over the years, and not intuition, as some aircraft technicians were inclined to characterize Berezhnoy's alertness, which once again did him good service, helping him spot and promptly correct a hidden problem in the gear extension system.

In this connection I should like to stress the following. The more frequently you come in contact in your daily activities with knowledgeable specialist personnel who enjoy a strong reputation in the regiment, the more you become convinced that their success is determined in large measure precisely by excellent professional qualities, solid knowledge and skills.

Picture the following situation: on the eve of flight operations, inspection of aircraft systems indicated that all parameters were normal. The aircraft technician has no solid reason for concern. As we sometimes say, however, some sixth sense tells him that something is wrong in the aircraft's "organism." Aviation engineer service specialist personnel proceed to examine, on the flight line or in the technical maintenance unit's laboratory, the component in question. Frequently they reach the conclusion that it could fail, if not during the next flight, then on subsequent flights. You end up discussing the question of sixth sense.

I know from personal experience that at first a technician or mechanic might himself not be able to explain why he received a mental warning signal from the operation of a given system. But after carefully analyzing his procedures as well as conditions in which the inspection had taken place, the aviation engineer service specialist can confidently state the reason. It may be a sound which is untypical for the operation of a given component or system, the color of oil or fluid which has changed after a flight, a strange odor in the cockpit or equipment bay, the appearance of smoke, and many other things. This is why one should never forget a prime rule in aviation: if you have any doubt about the functioning of any assembly or component, definitely check it. If you feel that your own knowledge and experience are insufficient, turn to more experienced comrades for advice and help.

What is the best and most effective way to instill and develop these professional qualities, which are so priceless to aircraft technicians? I believe this question should be a matter of concern to every aviation engineer service officer-supervisor, and especially those who have recently been placed in charge of maintenance groups.

Considerable reserve potential for further increasing combat readiness, discipline, and organization in all elements of the aviation collective, as well as flight operations safety, is to be found in development of an innovative approach by aviation personnel to combat training, operation and maintenance of aircraft equipment, of course together with performing other indoctrinational tasks. This is why the forces-wide initiative entitled "A qualitatively new level of mastery of new combat equipment!" today seems to be no longer merely an appeal, a point of reference in training and indoctrination of aviation engineer service specialists, but a law governing their daily lives and work, an essential condition for success in accomplishing assigned combat training tasks.

Aware of this fact, in our unit we have noticed, for example, that as a rule those officers who, prior to coming to the squadron, had served in a regimental technical maintenance unit more rapidly become good aircraft technicians and chiefs of flight technical maintenance units and servicing groups. Incidentally, that same Gds Sr Lt V. Saverin once worked as a technical maintenance unit servicing and maintenance group airframe and powerplant technician. We already know how beneficial this was to him.

The fact is that in a technical maintenance unit specialist personnel as a rule constantly see assemblies, components or systems on an aircraft which has been opened up and taken apart. This enables them to gain a graphic picture of all the unique features of their layout, assembly, disassembly, and operation in interaction with other components and systems. And this is particularly important for understanding the substance of the physical processes taking place in airframe and powerplant mechanisms and to achieve rapid mental or graphic modeling of these processes.

In addition, technical maintenance unit engineer and technician personnel, who have highly-accurate testing and diagnostic equipment at their disposal,

engage in investigative research activities much more frequently than in the squadrons.

Quite understandably it is not always possible to designate as aircraft technician or flight technical maintenance unit chief only persons who have worked as technical maintenance unit specialist personnel. It is possible and necessary, however, to help squadron aviation personnel develop and improve the requisite job-related qualities and to deepen professional knowledge and skills.

I shall cite an example. The automatic fire-extinguisher system on one of the aircraft was triggered through the fault of the technician. This incident was critiqued in detail in the squadron, and subsequently was thoroughly analyzed at a technical analysis session. Following a class on theory, all aviation engineer service specialist personnel gathered at the technical maintenance unit, where they viewed the fire-extinguishing system in operation directly on an unbuttoned and partially torn-down aircraft. The demonstration was accompanied by a technical explanation by the servicing and maintenance group chief -- how, when, and why this system can activate on the ground. This instruction session was highly beneficial.

We have now incorporated this learning method. Frequently technical training classes and analysis sessions both dealing with errors and mistakes by personnel and with advanced techniques and methods of aircraft servicing and maintenance are supplemented by practical demonstration on the aircraft. Brief technical drills are also being adopted more and more widely, fostering the development of innovative elements in the activities of aviation engineer service specialists and the development of analytical thinking in these personnel. Together with vigorous ideological-political and moral-ethical indoctrination, measures to improve the professional and job-related qualities of aviation personnel are producing very tangible effect.

Our guardsmen have successfully completed the training year and have received a mark of excellent on the main examination during the final period -- a tactical air exercise with live fire. They are continuing to build upon their successes in combat and political training and in socialist competition to greet the forthcoming 27th CPSU Congress in a worthy manner.

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NATO PORTRAYED AS SINISTER U.S. TOOL

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 38-39

[Article, published under the heading "Imperialism -- Enemy of Peoples," by L. Chernousko: "NATO -- Sinister Alliance"; based on materials published in the foreign press]

> [Text] All of us can see that a very dangerous tilt has occurred in the policy of the major capitalist powers. The passage of time and the practical actions of imperialism, especially U.S. imperialism, are illuminating the essence of this policy in increasingly high relief: recouping of social losses on the basis of gaining military superiority over socialism, coercive pressure on progressive, liberation movements, and maintaining international tension at a level which would justify the development of more and more new weapons of mass destruction, and militarization of space.

From the proceedings of the October (1985) CPSU Central Committee Plenum

The victory over Fascist Germany and imperialist Japan, a decisive contribution to which was made by the Soviet Union, radically altered the political map of the world and exerted profound influence on the destiny of countries and peoples. Socialism emerged from the framework of a single state and became a world system, the principal force opposing imperialism.

Reactionary circles in the West responded to this with a sharp intensification of military preparations. Hardly had the echo of the final salvos of World War II died down when our recent allies in the anti-Hitler coalition -- the United States and Great Britain -- adopted a policy aimed at undermining multilateral cooperation and launched hegemonistic, aggressive theories of "containing" and "driving back" communism. They were counting on military force and a bloc strategy. The Leninist appraisal of the steady growth of militarism and aggression as a characteristic trait internally inherent in monopoly capital was once again convincingly confirmed. "World domination," wrote V. I. Lenin, "concisely stated, is the content of imperialist policy, a continuation of which is imperialist war."

Such blocs as NATO in Europe, CENTO in the Near and Middle East, SEATO, ANZUK, and ASEAN in Southeast Asia, ANZUS and ASPAC in the Pacific region, OAS in Latin America, and others were created at the initiative of and with the most active participation of the United States. A leading position among these blocs was taken by the NATO alliance, established in April 1949. Today its membership includes 16 capitalist countries with a population of approximately 600 million and considerable military-economic potential.

The founders of NATO hypocritically called this exclusive North Atlantic military-political grouping of imperialist powers a "defensive" alliance. But the true goals of NATO have nothing in common with a defensive mission. Nobody ever has threatened or is now threatening the member countries of this alliance. This treaty is of a clearly-marked aggressive character and is directed primarily against the USSR.

It is evident from the decisions adopted this year at the NATO Council session, at meetings of the Eurogroup, the Military Committee and the Military Planning Committee that the bloc's general policy has remained unchanged: continued escalation of the nuclear and conventional arms race, deployment in Western Europe of the planned number of Pershing II and cruise missiles, and strengthening of the military alliance of the treaty partners. Other agenda items included arms buildup measures for the immediate future and for the next two decades. For example, the NATO countries are planning to increase their total number of tanks by 7 percent, combat aircraft by 22 percent, and antitank weapons by 40 percent by 1989. Thus the quantity of means of destruction will increase substantially.

Not all of the U.S. bloc partners, however, support Reagan's program to militarize space, on which the U.S. military budget is allocating almost 3 billion dollars in 1986, twice this year's amount.

The aggressive, predatory nature of the imperialist states is manifested most fully and emphatically in the social nature and function of their armed forces. The bourgeoisie utilizes them as an instrument of suppression against its own people and revolutionary, national liberation movements, an instrument of external political and economic expansion.

This can easily be traced in the example of the structure and combat training of the armed forces of the NATO member countries. Today they total approximately 6 million men, who are being rote drilled for war against the "reds" and are being brainwashed to take part in aggressive actions under the phony pretext of "defending Western civilization." The foundation of the structure of the military organization and organizational development of NATO joint forces is the so-called principle of "integration" and "interdependence." The member countries of this bloc are viewed by Washington as a "manpower pool" and rich source of "cannon fodder." The armies and navies of the U.S. allies are to all intents and purposes an appendage of the Pentagon.

The NATO leader -- the United States of America -- has built a gigantic war machine, unprecedented in peacetime. The United States has more than 3

million officers and men under arms. Of this total, half a million men are stationed on foreign soil. They operate more than 1,500 U.S. military bases and facilities in 32 countries. As U.S. Secretary of Defensse Caspar Weinberger admitted, the Pentagon stations abroad up to one fourth of its ground forces, one third of its combat-ready divisions and air assets, more than two combat fleets, and the overwhelming majority of its strategic nuclear submarines. A total of 330,000 armed Yankees (and an equal number of civilian employees) are stationed just at military bases in the FRG. The United States has stockpiled approximately 7,000 nuclear munitions in Western Europe. No other country in the world today maintains such large military forces abroad. And no other nation uses military force with such an aggressive thrust.

Seeking to end military-strategic parity and to gain U.S. military superiority over the USSR and NATO superiority over the Warsaw Pact Organization, Washington is taking further steps. By the end of the 1980's it plans to deploy 100 MX missiles (1,000 nuclear warheads of hundreds of kilotons each) and to build 100 B-1B bombers capable of carrying 3,000 nuclear warheads in a single sortie. Incidentally, the first B-1B squadron is scheduled to be formed in September 1986. It is planned to build 5-6 Ohio class nuclear-powered fleet ballistic missile submarines. Foreign experts forecast that in the 1990's more than 1,700 advanced nuclear missile weapon systems will become operational, such as the Midgetman ICBM, the Trident II submarine, the Stealth bomber, and the next generation of cruise missiles.

NATO leaders possess another type of barbaric weapon -- chemical weapons, stockpiles of which total 150,000 tons, with more than 3 million units of chemical munitions. But even this monstrous quantity of death-dealing weapons is not enough for the "hawks" across the ocean. Deployment of enhanced-radiation weapons in NATO countries remains on the agenda. If to all this we add the military arsenals of Great Britain, the FRG, Italy, Turkey, and other members of the bloc, it becomes obvious that the imperialist maniacs are amassing massive weaponry intended for the destruction of entire countries and peoples.

Since the creation of NATO, it has to its disgraceful credit a total of 130 aggressive acts against socialist and young independent countries. From 1964 through 1975 alone U.S. military forces were utilized for political purposes on 215 occasions. The number of incidents is even greater today. Let us recall the events in Iran, Lebanon, on Grenada, and in Nicaragua.... During this same period the White House has on 33 occasions resorted to threatening the employment of nuclear weapons, placing the world on the brink of disaster.

NATO directly or indirectly bears responsibility for kindling local conflicts in the countries of Asia, Africa, and Latin America, in which 25 million persons have been killed since World War II. We should stress that expansion of the geographic zone encompassed by NATO -- this gigantic imperialist octopus -- is increasing its role as the principal aggressive grouping of capitalist nations for the conduct of neocolonial policy.

The activities of this sinister alliance are also filled with examples where the bloc's most aggressive circles, behind which stands the dark shadow of the White House, the Pentagon, and the CIA, have played the role of jailer over

their own peoples, and frequently that of a national police force as well. Suffice it to recall the naked coercive pressure exerted on France and Italy in order to prevent the election of Communist Party candidates as members of their government. Or take Operation "Prometheus," a plan drawn up at NATO headquarters, execution of which brought the "Black Colonels" to power in Greece. Neofascism and revanchism are flourishing in the FRG under the aegis of NATO.

The growing potential of the forces of peace, however, confronts the aggressive policy of imperialism. This potential also includes the vigorous, consistently peace-seeking policy of the socialist states and their growing economic and defense might. The new draft version of the Program of the Communist Party of the Soviet Union stresses: "The CPSU proceeds from the position that no matter how great the threat to peace created by the policy of aggressive imperialist circles, there is no foreordained inevitability of world war. It is possible to prevent a war and to save mankind from calamity. This is the historic mission of socialism and of all the world's progressive, peace-loving forces." The CPSU and the brother Communist and worker parties, concerned with maintaining peace and the security of peoples, are educating the people and military personnel of their countries in a spirit of a constant, high state of readiness to offer resolute countermeasures to the intrigues of the forces of imperialism and reaction.

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DEVELOPMENT OF TRAINING SIMULATOR EQUIPMENT FOR ENGINEERS, TECHNICIANS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 40-41

[Article, published under the heading "The Reader Continues the Discussion," by Maj Gen Avn Yu. Dozhdikov, commanding officer, Riga Higher Military Aviation Engineering School imeni Yakov Alksnis: "Improving Technical Training"]

[Text] The topic addressed in an article by Maj Gen Avn A. Grishin entitled "Squadron Engineer. What Should He Be?" (AVIATSIYA I KOSMONAVTIKA, No 11, 1984) and continued in a number of reader response articles, is a matter of deep concern not only to supervisor personnel of the aviation engineer service of line units but also to service school faculty members, for the basic qualities of the aviation engineer as a specialist, organizer, and supervisor begin to form precisely here.

I should like to discuss a matter which has a direct relationship to the discussion in question: improvement of technical engineering training of aviation specialist personnel, and particularly its fundamental components -- organization, methodology, and technical means of instruction.

Practical realities dictate the necessity of professional preparedness on the part of aviation specialists at all levels: engineers, technicians, and mechanics -- as a guarantee of effective operation and maintenance of combat aircraft. Practical experience indicates, however, that even a high level of theoretical preparation of specialist personnel does not guarantee performance of job duties at a high level of professional competence and a high degree of reliability. Also essential is a high level of technical knowledgeability and competence, characterized not only by knowledge but ability as well, for incorrect performance of given operations as a rule leads to aircraft equipment failure, with various consequences: taking costly equipment off the line and unforeseen downtime for a fixed-wing or rotary-wing aircraft due to equipment failure.

A system of knowledge, abilities and skills, which depend to a considerable degree on the nature of the job performed and position held, occupies a certain place in the structure of the person of the military aviation engineer or other specialist. Engineering and technical training of aviation

specialist personnel, which requires continuous improvement, also fosters the amassing of job-related knowledge in line units, with subsequent honing of abilities and skills.

In what ways is it possible to resolve this problem, dictated by practical realities? Analysis of the experience amassed by the aviation engineer service of Air Forces units enables one to conclude the need for further improvement of methodology of engineering and technical training, with emphasis on its practical application. This should be reflected first and foremost in planning the subject matter of training classes for the coming year and periods of training, as well as in the method of conduct of training classes. Toward this end it is important to prescribe not only study of the characteristics and principles of operation of individual systems but also mastery of procedures prescribed by the appropriate aircraft maintenance documents and manuals. A special role here is played by training drills, which directly introduce specific changes both in method and preparation of engineers and instructors for training classes.

At the present time independent study is the principal form of officer learning activity. A varying approach to its organization in the units, however, as well as the difficulty of verifying results of assimilation of technical information, provide grounds to believe that the quality of its conduct leaves much to be desired. Therefore it is most advisable to plan engineering and technical training taking into account the categories of student personnel, the level of their professional competence, and interruptions in their work experience. As regards types and number of training drills, they should be determined proceeding from the level of qualifications and individual proficiency of specialist personnel and the necessity of these personnel maintaining the required abilities and skills at a specified level.

A leading role in this important business is of course played by the unit deputy commander for aviation engineer service and the specialization-area engineers. It is their job to draw up the subject matter, to determine the method of conduct of engineering and technical training, and continuously to monitor its progress, effectiveness, and quality.

Wherever aviation engineer service supervisors approach this business in a serious manner, the proficiency level of personnel is high, and there are no violations in aircraft operation and maintenance procedures on the part of flight, engineering and technician personnel. For this reason I am in full agreement with Maj Gen Avn A. Shelekh's opinion stated in the article "Engineer on the Airfield" (AVIATSIYA I KOSMONAVTIKA, No 2, 1985) to the effect that precise organization of the training of one's subordinates is essential. The unit commanding officer, staff officer, and engineer are the primary persons who should deal with this. This difficult task cannot be accomplished in a prompt and timely manner without the active participation of the party and Komsomol organizations. A personal example by Communists and Komsomol members and their mobilizing role take on paramount importance here. The deputy commander for aviation engineer service at every level should mandatorily take all this into account in his job-related activities.

Now I should like to discuss another, no less important problem: technical means of job training, their composition, availability, and degree of sophistication. Experience indicates that it is a simpler matter to organize group class activities than practical training activities, particularly training drills. But specialist personnel can acquire solid skills only by repeatedly practicing the same operational procedures, and directly on simulated or actual equipment. At the same time repeated practicing of installation-takedown, adjustment and other operations for training purposes on a combat aircraft which is in perfect operating condition is extremely undesirable, first and foremost because this diminishes the aircraft's reliability, and also because it involves additional expenditure of time on secondary procedures.

Consequently, for the conduct of purposeful engineering and technical training of aviation personnel one should in our opinion proceed in the direction of developing effective, modern technical means of job training of aviation engineer service specialist personnel, ensuring that they constantly maintain a specified level of professional knowledge, abilities and skills.

But what is the situation at the present time? Several models of mock-ups of systems and component units are commercially manufactured. But they provide only for primary study of the design, construction, and principle of operation of components and assemblies in the principal occupational specialties, and help develop mnemonic and thinking processes in trainee personnel.

Endeavoring to solve this problem, innovators in Air Forces subunits and units design and build various training simulators for demonstrating to aviation engineer service specialist personnel the elements of design and construction and for performing various work procedures. These training devices, however, are as a rule built only to the extent of local capabilities and on the basis of personal notions on the advisability of employing them, which naturally fails to ensure the fullest volume of task accomplishment.

At our school inventors and efficiency innovators of the departments have designed, built, and are utilizing with effect in the training process unique models of aircraft simulator devices for aviation engineer service personnel. Vigorous efforts are presently in progress, to improve their design, construction, and instructional capabilities. In the department headed by officer P. Yablonskiy, for example, a team of innovators consisting of officers V. Plyamovatyy, A. Matyushenko, and Yu. Bogdanov has designed and built an aircraft avionics training simulator, which makes it possible not only to acquaint students with the principles of operation, specific features of design, operation and maintenance of electronic equipment, but also to simulate typical malfunctions and failures and ways to locate and correct problems utilizing test equipment. Malfunctions and failures are injected by program, without instructor intervention. In the department of aircraft equipment maintenance, efficiency innovators officers A. Parygin, V. German, and A. Raspopov, under the supervision of department head officer Ye. Meshkov, have designed and built an entire aggregate of training devices and equipment, on which we conduct practical and laboratory class sessions. Some of these have been displayed at the Exhibit of Achievements of the USSR National

Economy and have been submitted as entries in Air Forces innovator competitions, where they have received praise by veteran experts.

Of particular interest is an aircraft equipment training simulator on which a student, after studying a given system, can compare his knowledge with standard information recorded on tape, and at the end of class sessions can test his own knowledge using a list of specially-devised problem situations with the aid of a videotesting device.

In the department of flight safety, under the guidance of officer R. Karapetyan, a specialized modern fighter control system simulator has been devised and built. It enables students to acquire and improve skills in control system checking and adjusting, and to analyze typical control system failures and the causes of malfunctions with the aid of a projection device and set of slides. Experience in utilizing such training simulators in the learning process over a period of years enables us to conclude that considerable improvement is accomplished in the training of future aviation engineers. In addition, simulator training provides considerable economic effect in comparison with using actual equipment. This is achieved by correctly taking into account the basic principles of design and construction of simulator devices and the recommendations of engineering psychology and ergonomics. There is no doubt that such principles and recommendations will be useful to efficiency innovators in line units.

I believe that it is appropriate to remind them of a fundamental requirement of engineering psychology on such training devices: the psychological structure of the actions performed by specialist trainees should correspond to the actual procedures performed on aircraft equipment. Only if this is true does a training device form correct sensomotor skills in perception, evaluation, and processing of information, decision-making and performance of appropriate actions, which are subsequently carried over to an actual aircraft.

In determining a list of typical aircraft equipment failures and malfunctions to be simulated, it is essential to proceed first and foremost from the results of analysis of their actual causes and to seek faithfully to reproduce their symptoms.

From the standpoint of design and construction, training simulators for aviation engineer service specialists can include aircraft systems and equipment, and all components with which the maintenance specialist interacts directly in the training process, as well as access pathways and equipment securing hardware and assemblies, and their positioning relative to the axis of the aircraft should be realistic. When appropriate a training simulator should include an electrical power supply duplicating that of an aircraft, including wiring and junction boxes, panels and connectors. Instruction on finding and correcting malfunctions, adjusting and calibration employs test points, which makes it possible to use the same test equipment as on an actual aircraft.

In our opinion training simulator classrooms should include actual electric power sources, actual test equipment, equipment for projecting filmstrips,

excerpts from training films, a set of color cartoon-type films on the operation of aircraft systems both when in proper working order and with the occurrence of typical malfunctions, as well as a set of slides showing system components and sectional views of same. Specialization-area engineers should play a primary, principal role in determining the direction of development of specific simulator devices. But this does not mean that subunit aviation engineer service supervisors should stand apart from this. Information support of the simulator training process, simulator training methodology, and training of instructor personnel are matters which affect engineers at all echelons.

Design and construction of specialized training simulators for engineer and technician personnel is a demand of the times, dictated by the requirements of scientific and technological advance. The development of aircraft equipment today imperatively advances the task of commercial series manufacture of training simulators for aviation engineer service personnel. This will make it possible maximally to utilize scientific and technological advances and a standard technology in designing and building such equipment, and in the final analysis will broaden the professional knowledgeability of aviation specialist personnel. In my opinion the aircraft designer and builder should be closely involved in designing and building training simulators for specific aircraft.

The complexity of design and construction of modern fixed-wing and rotary-wing aircraft as well as the need for a substantial improvement in the effectiveness of job-related training of engineer and technician personnel make it necessary to design and build a set of specialized training simulator devices for each occupational specialty and for each new aircraft.

The availability of such training simulator devices in Air Forces units will make it possible to raise to a qualitatively new and higher level the engineering and technical training of flight personnel, engineers and technicians, to improve and maintain their professional skills at a high level, and to ensure a high degree of aircraft reliability and combat readiness.

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ACTIVITIES OF EUROPEAN SPACE AGENCY DESCRIBED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 42-43

[Article, published under the heading "Responding to Readers' Questions," by D. Goldovskiy: "ESA Space Agency"; based on materials published in the foreign press]

[Text] Officer N. Shkodenko and other aviation personnel made the request at a reader conference that this journal discuss the activities of the West European space agency. They would like to know what countries are members of ESA, who plays a leading role in this agency, and what is its future?

D. Goldovskiy, a scientific consultant for this journal, replies to the readers' questions.

History of Establishment

The governments of the majority of West European nations recognized fairly early on that no country would be able to ensure a level of world standards for its industry and ability to compete in the world market if it did not take active part in space research and utilization. The financial and technical resources of the nations of Western Europe are far from equal. Some countries would be unable to maintain an independent space program. This is why the governments of these countries chose cooperative endeavor, which enables them to pool their efforts.

The beginning of cooperative endeavor by the West European countries in the investigation and utilization of space dates back to November 1961, when ESRO (European Space Research Organization) and ELDO (European Organization for the Development of Launch Vehicles) were established. Members of the former included Belgium, Great Britain, Denmark, Spain, Italy, the Netherlands, France, Switzerland, and Sweden, while membership of the latter included Belgium, Great Britain, Italy, the Netherlands, France, and the FRG. Their activities cannot be called a success. ESRO launched 8 small scientific satellites (including one backup satellite). ELDO developed the Europe I and Europe II boosters, but flight tests were unsuccessful, and not one satellite

was launched into orbit by these rockets. All eight of the above-mentioned satellites were launched into orbit by U.S. boosters.

The European Conference on Space was established in Brussels in 1973, at the minister for research and technology level, attended by the ministers for research and technology of 11 West European countries: Belgium, Great Britain, Denmark, Spain, Italy, the Netherlands, Norway, France, the FRG, Switzerland, and Sweden. At this conference the decision was made to combine ESRO and ELDO into an organization to be named ESA (European Space Agency), to increase total appropriations, and to step up efforts to develop and launch nonmilitary applications satellites.

At the same time plans were laid to develop a West European launch vehicle, the Ariane, capable of lifting satellites into stationary orbit. This would make the West European countries less dependent on the United States which, fearing competition, was virtually refusing to allow U.S. boosters to be used to launch West European satellites. At the same time the conference adopted a NASA proposal calling for development of the Spacelab manned orbital laboratory, which would be carried in the cargo bay of the U.S. Space Shuttle.

Organization

ESA did not formally begin functioning until 1975. All countries (except for Norway) which had taken part in the European Space Conference became "full" members of ESA. Ireland was accepted as the 11th member. In addition, Austria, Norway, and Canada joined ESA as associate members, with somewhat limited rights and privileges, and in 1985 Finland applied for associate membership. A dominant role in ESA is played by France and the FRG, with Great Britain and Italy forming a second level, Belgium, Spain, the Netherlands, and Sweden at a third level, while the remaining countries participate in a comparatively modest fashion.

The ESA supreme body is the conference of ministers of research and technology of the member nations, which is convened (fairly infrequently) to determine strategic goals and ratify the principal points of plans for the future. The most recent meeting of the conference took place in Rome on 30-31 January 1985. An agency program of activities extending to the year 1995 was hammered out at the meeting.

Day-to-day administration is handled by the ESA Council, headquartered in Paris. It consists of eight directors and a director general. The first director general (to 1980) was a Briton, Gibson, the second (to 1984) was a Dane, Quistgard, while currently this post is held by a representative of the FRG, Lust. ESA maintains two scientific and experimental centers -- at Nordwijk (Netherlands) and Frascati (Italy), a space vehicles flight control center at Darmstadt (FRG), a space launch center at Kourou in French Guiana, a facility which formerly belonged to France and, finally, its own network of tracking stations.

We should state that the scientific and experimental facilities belonging to ESA are fairly limited, and it has no production facilities of its own. Therefore in its activities ESA relies on West European industrial companies

and scientific research organizations (commercial or academic), with which ESA contracts. It works directly with companies and universities, bypassing the governments of the corresponding countries. The international character of ESA programs has resulted in the establishment of West European industrial consortia, which join together companies of several countries.

Each ESA member country determines for itself in which programs of this organization it will take part and the degree of financing it is willing to assume. A program is considered ratified if appropriations covering at least 80 percent of its total cost have been secured. If a country has assumed, let us say, 30 percent of total cost, it is entitled to require that 30 percent of contracts (in value) are let to companies in that country.

Results of a Decade of Activities

ESA has become the third collective "space power," after the USSR and the United States, in scale of moneys allocated for space research and utilization. Allocations totaled approximately 1 billion dollars in 1985.

The most significant achievement of ESA in past years has been the development of the Ariane I, Ariane II, and Ariane III boosters (payload of 1,780, 2,100 and 2,560 kg respectively). They can lift the above-indicated payload weight into a transfer orbit with a 200 km perigee and a 36,000 km apogee. Subsequent transfer into a stationary orbit is handled by an onboard propulsion unit, which weighs approximately one half of the total payload.

ESA is presently almost totally independent of the United States. In addition, Ariane rockets are competing with increasing success against the U.S. space shuttlecraft. For a number of reasons, commercial customers prefer the Ariane, although the Shuttle is cheaper at the present time. Shuttle payload rates are rising, however, while rates for the Ariane are dropping. The Ariane IV booster is scheduled to become operational in 1986 (payload to 4,300 kg).

Another important acheivement of ESA is development of the Spacelab manned orbital laboratory. ESA spent more than a billion dollars on this laboratory and turned it over to NASA, receiving niggardly compensation -- the right to conduct experiments without charge on the first flight of the Spacelab on board a U.S. Shuttle at the end of 1983. The laboratory flew its second and third missions in April-May and July-August of this year, but involved U.S. space research projects. Another mission is scheduled this year, but it may not take place: the Space Shuttle is not very reliable about meeting mission timetables. This is one of the reasons why many payload customers prefer Ariane.

In general relations between ESA and NASA cannot be called friendly. Time and again the United States has let down its West European partners, declining to continue joint-program activities, after which ESA has been forced either to abandon a program altogether (as was the case with the Aerosat program to develop an aviation services satellite) or to continue a program independently, assuming all costs which it had previously hoped to share with

the United States (this was the case with the program to develop the Ulysses unmanned interplanetary probe).

In the last decade ESA has built a number of scientific and nonmilitary applications satellites, including the Geos stationary-orbit research satellite, the ECS European regional communications system satellite, the Marex marine navigation satellite, the Spot earth resources satellite, and the Meteosat weather observation satellite. This year an Ariane I booster launched the West European Giotto unmanned interplanetary probe toward Halley's Comet.

A highly interesting vehicle is the West European Ulysses unmanned probe, which is to be the first vehicle in the history of space exploration to leave the plane of the ecliptic and investigate the polar regions of the Sun. This probe is very heavy, and the Ariane booster is not powerful enough to lift it into the required interplanetary trajectory. It is to be launched in 1986 on board the Space Shuttle.

Prospects for the Future

The conference of ministers of research and technology which was held in Rome in January 1985 ratified two major programs -- Ariane V and the Columbus program. The former calls for the development of an Ariane V booster by 1995, capable of lifting into a transfer orbit a payload weighing up to 8,000 kilograms, and an almost 20-ton payload into low orbit. This rocket could launch a small reusable manned spacecraft. France has already designed such a craft, dubbed the Hermes, but it was not ratified at the conference, since at the present time this is a French, not an ESA program. The spacecraft launch weight is projected to be 16.7 tons, with a 4.5 ton payload and a 4-6 man crew.

Columbus is a program to design and build individual modules for the future U.S. permanent manned space station, which is to become operational in the mid-1990's. ESA, having learned by the bitter experience of collaboration with the United States, decided to develop these modules so that they could be developed into a West European space station in case the joint project with the United States were to fall apart.

The long-term ESA program extending up to 1995 calls for the development of a number of scientific, communications, and weather satellites, a large experimental satellite for direct TV broadcasting, as well as earth resources satellites. Under consideration are interplanetary probes to investigate the Moon, Mercury, Venus, Mars, Saturn, Titan (a satellite of Saturn), comets and asteroids. It has not yet been decided which of these is to be accomplished within this time span. There are good prospects for the Cassini project, involving the development of a probe to investigate Titan's atmosphere.

The Soviet Union has invited ESA to take part in the Soviet Phobos program (Phobos is a satellite of the planet Mars). According to this program, in 1988 a Soviet unmanned interplanetary vehicle will be launched toward Mars, with a separating probe which will approach Phobos to a distance of 50 meters

and will image and investigate this celestial body. ESA could provide several scientific instruments for such a mission. A cooperation agreement was signed between the USSR Academy of Sciences and ESA in the 1970's, and the Phobos program could help implement this agreement.

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BENEFITS TO THE ECONOMY FROM REMOTE EARTH SENSING

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 85 (signed to press 1 Nov 85) pp 44-45

[Article, published under the heading "The Space Program Serving Science and teh Economy," by Academician V. Avduyevskiy and Doctor of Technical Sciences G. Uspenskiy: "Remote Earth Sensing"]

> [Text] Study of the Earth by remote methods has in recent years become one of the principal areas of space-based research. The arsenal of hardware providing capability to inspect our planet from orbit is fairly extensive: still, motion-picture and TV cameras, infrared and imaging radar instruments, radio-frequency and laser detection and ranging equipment. This journal has carried articles on the results of remote sensing with the aid of manned and unmanned space vehicles. The following article by Academician V. Avduyevskiy and Doctor of Technical Sciences G. Uspenskiy offers our readers an analysis of future prospects for investigating the Earth with the aid of space hardware.

The effectiveness of such branches and sectors of the economy as agriculture, water resources, forestry, fisheries, geology, and the oil and gas industry depends to a considerable degree on study and efficient utilization of the Earth's resources.

Economy branches and sectors spend from 3 to 10 years on each updating of information on our country's natural resources. In addition, such an updating is insufficiently complete both as regards coverage area and quality of obtained information, and this diminishes the effectiveness of a number of branches and sectors of the economy. High-quality information can be obtained with the aid of orbital vehicles, and it can be updated at intervals of several weeks.

The traditional methods of investigation are unable to provide, for example, solution to many agricultural problems to the required degree of completeness and promptness, while orbital imagery provides the capability to accomplish this, since it carries the requisite information on the status of crops, soil temperature and humidity, utilization of agricultural land, reserves of plant mass on pastures and grazing land, deployment of agricultural equipment, and

pace of conduct of planting and harvesting operations. Utilization of data obtained from orbit enables planning and executing agencies to take prompt and effective steps locally, directed toward intensification of agriculture.

In the area of geology, employment of orbital imagery has alredy helped refine and detail the geologic structure of a number of this country's oil and gas-producing regions and to identify several hundred geologic features identified with structures which are promising for oil and gas prospecting. The location of a number of oil- and gas-bearing areas around the Caspian, in Central Asia and Western Siberia has been refined and detailed with the aid of remote orbital sensing. In 50 areas identified with orbital remote imagery, detailed exploration is in progress to locate such minerals as oil, tin, copper, and mineral construction materials. Utilization of orbital remotal sensing makes it possible to increase the volume of geologic mapping without additional expenditures, accelerating the development of new regions, particularly Siberia and the Far East.

Traditional means of studying and monitoring the status of forest fires with a 10-year periodicity are slow and highly labor-intensive. Remote earth sensing can accomplish these tasks at minimum cost and very rapidly. Coniferous and deciduous species, burn areas and clearcuts, areas of propagation of insect pests, and other factors essential for evaluating and monitoring the status of forest resources are clearly distinguishable in images taken from satellites. By observing focal areas of and smoke trails from forest fires, steps to put them out can be taken with the highest degree of promptness and efficiency.

The principal area of utilization of satellite imagery in water resources management and land reclamation is the preparation of land-reclamation and land-improvement cartographic materials for the purpose of arriving at well-validated technical solutions for planned land-reclamation and water-management facilities, land-management, hydrogeological, engineering-geology and specialized geomorphologic zonation, as well as maps of current land utilization. Orbital imagery makes it possible optimally to manage the water resources of river basins, which is particularly important for the arid regions of Central Asia and the southern part of this country. In addition, with the aid of orbital remote sensing one can monitor pollution of such seas as the Caspian, Black Sea, Sea of Azov, and the Baltic. Utilization of this information for the benefit of the USSR Ministry of Water Resources is making it possible to reduce the volume of outlays on field work by a factor of 2-3.

Determination of the aggregate of attributes on the basis of which natural features are distinguished from one another and development of modes of observing such features from satellites and methods of processing and subsequent identification of orbital-imagery information is the principal scientific problem of studying earth resources from space. Its complexity is due to the great diversity of natural features (tens of thousands) and the phases of their states (dozens), and in many instances poor distinguishability between them. In addition, the process of identification is considerably complicated by unstability of the atmosphere (by dust obscuration, fluctuations in temperature and humidity, turbulence), as well as by cloud cover and differing conditions of sunlight at the moments images are taken.

In order to solve this problem, simultaneously with satellite imagery, images are taken from aircraft, as well as ground observations of typical areas of the Earth. Ground observations provide reliable data on natural features, while aerial photographs provide images of the target areas with minimal distortions caused by the atmosphere. The aggregate of data obtained under various conditions serves as a basis for developing methods of processing satellite imagery and identifying natural features. It is analyzed at more than 400 organizations of the USSR Academy of Sciences, branches and sectors of the economy.

Utilization of satellite data on cloud cover and such characteristics of the atmosphere as temperature, humidity, pressure, and other weather parameters significantly improves the quality of weather forecasts. Information on the weather, the development of hazardous natural phenomena (cyclones, frosts, floods), the ice situation in the Arctic and Antarctic, and the state of the sea surface, obtained from weather satellites, is very important for supporting civil air operations, cargo and passenger vessels on the open sea. They greatly help in increasing safety of navigation and in obtaining savings in time underway.

Earth surveillance satellite systems provide the capability to determine, promptly and on a global scale, the location and physical state of objects and processes taking place on land, in the ocean and in the atmosphere. The interval for updating the cartographic base is determined by the intensity of change in the surface of the Earth, connected both with natural evolution and with human activity. It averages approximately 10 years.

Shorelines, shoals and shallow-water sections of the continental shelf require more frequent observation (approximately once each year) due to their comparatively high degree of variability. Accomplishment of this task is important for geology and transportation. Shoaling waters and continental-shelf zones are the most suitable for mineral prospecting and development, while topographic maps of such areas make it possible correctly to plan and conduct these operations. Shoreline, shoals and shallow-water sections of the continental shelf at the same time represent a navigational hazard to water transportation, and the charting of these areas is essential for compiling sailing instructions.

Data on the geologic structure of the Earth serve as input information for determining those locations which are the most promising for mineral prospecting. This includes first and foremost information on the form and mineral composition of the surface layer and the results of direct and indirect investigations of deep-lying strata. The forming of minerals has taken place principally in the vicinity of faults and fractures in the Earth's crust. Therefore information on the tectonic structure of the surface is extremely important in planning mineral exploration activities. Soil maps are the basis for planning planting operations in agriculture and forestry. Data on soils are also considered in water management and land reclamation, in designing and operating water management facilities. Information on soil erosion is essential for drawing up and implementing measures to correct the problem. Soil temperature and moisture content determine in large measure planting time, rate of maturing, and the projected harvest. In addition,

these data are utilized in land improvement in determining irrigation conditions.

Snow and ice cover forms a water resource which in the spring and summer provides moisture to the soil, fills reservoirs, and drains into lakes and seas. The rate of change in these resources greatly affects how much water remains in the soil and reservoirs and how much uselessly flows into the sea. This in turn determines the schedule and conditions of farm work, land improvement, water resources management, and hydroelectric power. Very rapid melting can cause flooding, a factor which is considered both in planning and designing structures located near flooding areas and their construction and operation. With limited freshwater resources for water management, land management and power, it is essential to have an accurate list of water sources, with indication of their location and operating regimen. This makes it possible to plan measures to accomplish efficient consumption of water resources. Information of subsurface water is important in arid regions. Data on locations, depth and quantities are essential for water management, land management, agriculture and construction. In view of the low degree of variability of subsurface water resources, the time interval between observations can run 10 years.

Data on development of vegetation are valuable for estimating productivity of pasture and other agricultural land. They are especially important in harvest forecasting, where an aggregate of factors is taken into consideration, including soil moisture and temperature, as well as prediction of rainfall and air temperature.

Harvest inventorying is essential in forecasting food supply and for drawing up measures to ensure efficient crop harvesting and storage. Forest inventory enables us to estimate timber resources and to determine ways to accomplish efficient timber harvesting.

Orbital remote sensing, in addition to rapid, prompt response and a high volume of information, offers a high degree of objectivity and coverage of large areas. For this reason satellite photography can be used to obtain photographic maps of cities and transportation networks, which undergo change comparatively rapidly. Such photographic maps are essential for evaluating their state and planning future development. In addition, the boundaries of forests, bodies of water, deserts, grassland, brushland, and forest zones can be determined on a regular basis. All this information on natural and man-made objects on the Earth's surface forms a basis for organizing efficient land use.

Detection of sources of pollution of the biosphere for the purpose of neutralization and cleanup is one of the main tasks of the environmental protection service. For inland bodies of water, for example, this would include thermal and chemical pollution as a result of vessel and watercraft collisions and sinkings, accidents on board tankers, other vessels and in oilfields, as well as from the discharge of industrial wastes; for the land surface and atmosphere -- chemical and mechanical pollution by industrial wastes. Success in the prompt and timely elimination of a source of pollution is determined in large measure by promptness in obtaining the necessary

information. Therefore surveillance systems must meet stringent demands in regard to promptness of acquisition of information (in the order of 24 hours). Even faster response is required in observing and monitoring disasters: fires, mudslides, avalanches, high water, floods, and dust storms.

Forest fires can be stopped at an early stage. It is very difficult and sometimes virtually impossible or simply disadvantageous (the cost of extinguishing becomes so great that it exceeds the damage caused by the fire) to put out an advanced-stage forest fire (which has been raging for 24 hours or more). For this reason a forest fire should be spotted within not more than 12 hours.

Information on initiation of mudslides and avalanches makes it possible to take steps to protect against them. Warning of high water, flooding, and dust storms provides the opportunity to prepare for them and thus to lessen their destructive consequences.

The rate of propagation of plant diseases is considerably slower than, for example, the rate of advance of a forest fire front. Therefore less rapid observation response is acceptable (up to 15 days). Prompt and timely detection of focal areas of plant disease and pest damage is just as important as detection of fires, for this makes it possible to localize and wipe out centers of infection.

Volcanic eruptions pollute the land, sea, and atmosphere with lava and ash. Surveillance of the eruption process provides the capability to determine the direction and scale of pollution and to plan measures to reduce the detrimental effects of an eruption.

Observation of the consequences of earthquakes (area and nature of destruction) provides the capability to take prompt and effective recovery measures and to come to the aid of victims.

Analysis indicates that the space program can help accomplish the tasks formulated by the Communist Party pertaining to carrying out new technological renovation of our nation's economy and shifting it over to intensive development.

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